Standard Size, 9 x 12. DECEMBER 29, 1904. Price Ten Cents.

AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

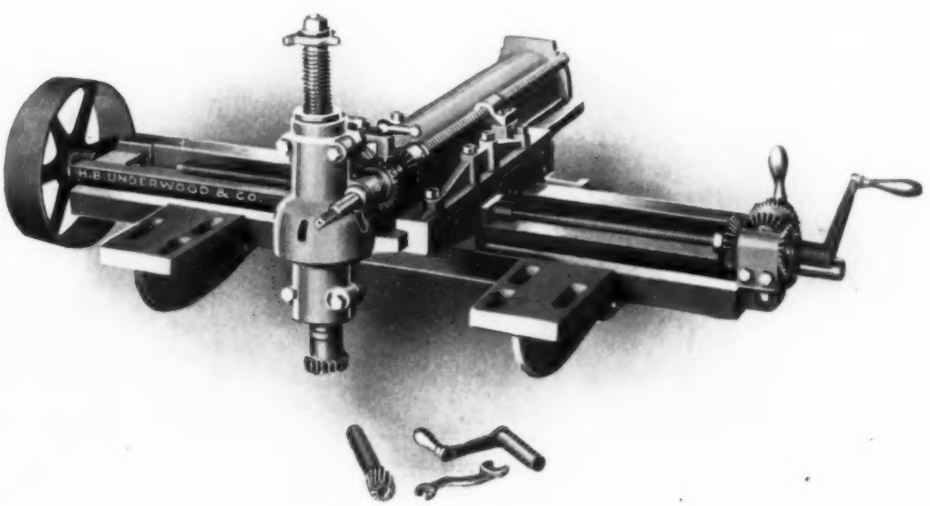
ISSUED WEEKLY BY THE HILL PUBLISHING COMPANY,

Vol. 27. WORLD BUILDING, NEW YORK. No. 52.

Index to Advertisers and Classified Index Following Reading Matter.

Portable Milling Machine

Designed and built especially for facing Steam Engine Valve Seats in solid steam chests. A useful tool for a wide range of various kinds of work which without this tool would have to be done in the machine shop. Why dismantle the engine? Take the tool to it and do the work on the spot—save time, trouble, cost.



It is strongly geared; has power feed in both directions and can be used in any position—horizontal, vertical or inclined. It can be operated by hand wheel, small steam engine, air or electric motor. It will face a valve seat 22 inches x 36 inches x 7 inches deep. Any size machine built to order. Communicate with us.
This is only one of many Portable Tools we make, for quick repairing.

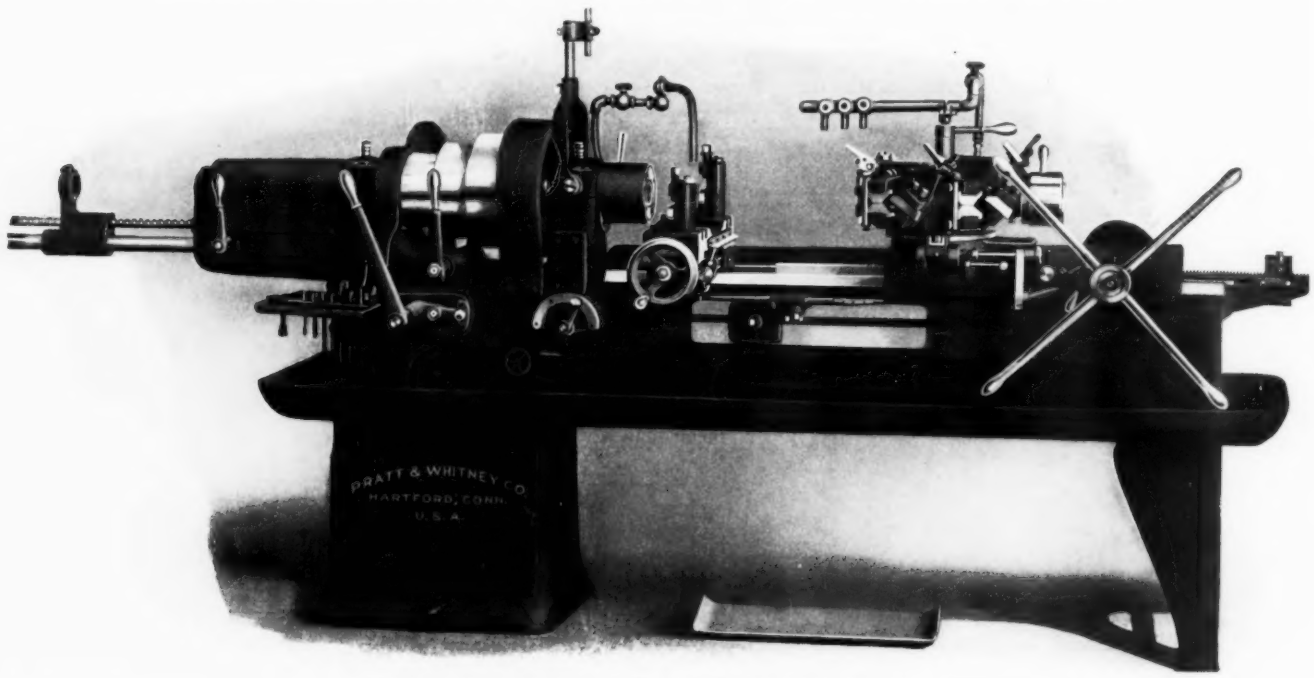
H. B. UNDERWOOD & CO.,

L. B. Flanders Mach. Works.

1021 Hamilton Street, PHILADELPHIA, PA.

PRECISION TOOLS

Awarded Grand Prize and Gold Medal, Louisiana Purchase Exposition.



2 x 26 inch Turret Lathe, Built in Five Sizes.

These machines are designed for rod work up to three inches in diameter and chucking work; fewer tools being required in chucking operations than with any other machines on the market. The use of the cross slide in connection with the turret enables both facing and boring operations to be carried on at the same time.

Turret Lathes,
Engine Lathes,
Shapers,
Gear Cutters,
Profiling Machines,
Rifling Machines,
Gun Barrel and Tube Drilling Machines,
Centering Machines.

Lincoln Milling Machines,
Thread Milling Machines,
Double Column Milling Machines,
Automatic Screw Machines,
Hand Screw Machines,
Die Sinking Machines,
Gang Drilling Machines,
Adjustable Multi-Spindle Drills,
Cutting-Off Machines.

PRATT & WHITNEY COMPANY,

136-138 LIBERTY STREET, NEW YORK.

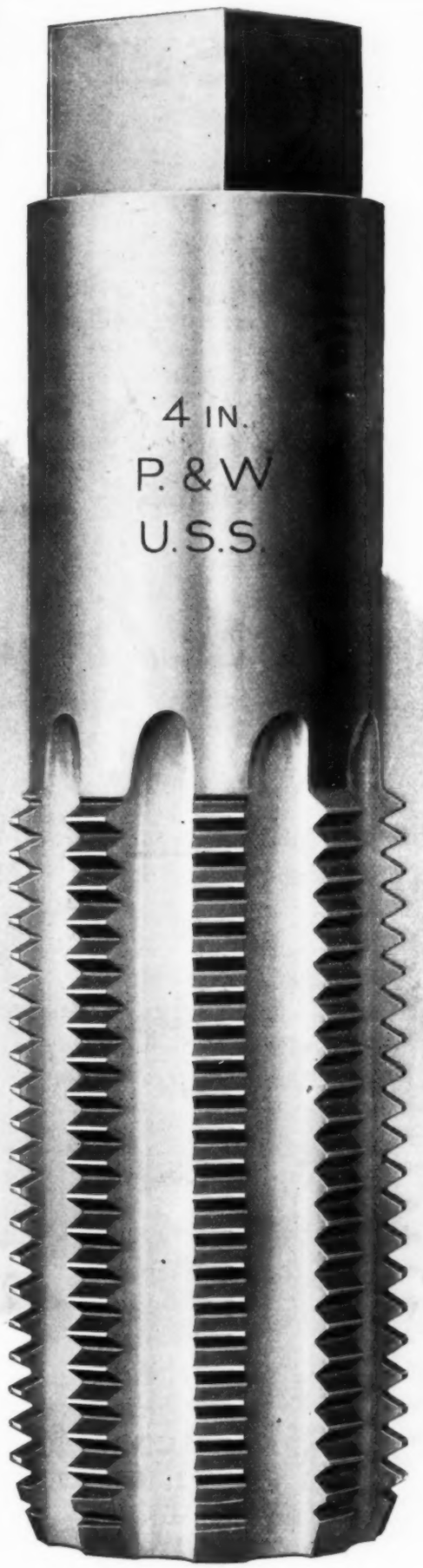
WORKS: HARTFORD, CONN., U.S.A.

OFFICES:

Boston: 144 Pearl St. Philadelphia: 21st and Callowhill Sts. Pittsburgh: Frick Bldg.
Chicago: 46 South Canal Street. St. Louis: 516 North 3d St. AGENTS: The Fairbanks Co., Montreal, Toronto, Winnipeg and Vancouver.

Small Tool Department

Send for Small Tool Catalog.



Taps, Dies
Reamers
Ratchet Drills
Boiler Punches
Lathe Tools
Die Stocks and Sets
Taper Pins
Standards
Gauges, etc.

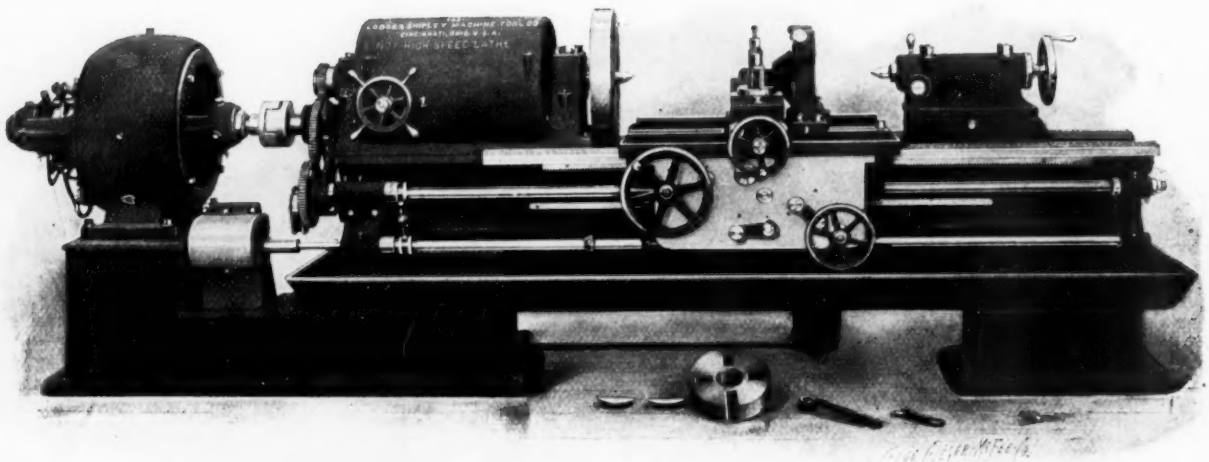
PRATT & WHITNEY CO.,

136-138 Liberty Street,
NEW YORK.
Works: Hartford, Conn.

OFFICES:—Boston: 144 Pearl St. Philadelphia: 21st and Callowhill Sts. Pittsburgh: Frick Building. Chicago: 46 South Canal St. St. Louis: 516 N. 3d St.

AGENTS: The Fairbanks Co., Montreal, Toronto, Winnipeg and Vancouver.

No. 1 HIGH SPEED LATHE

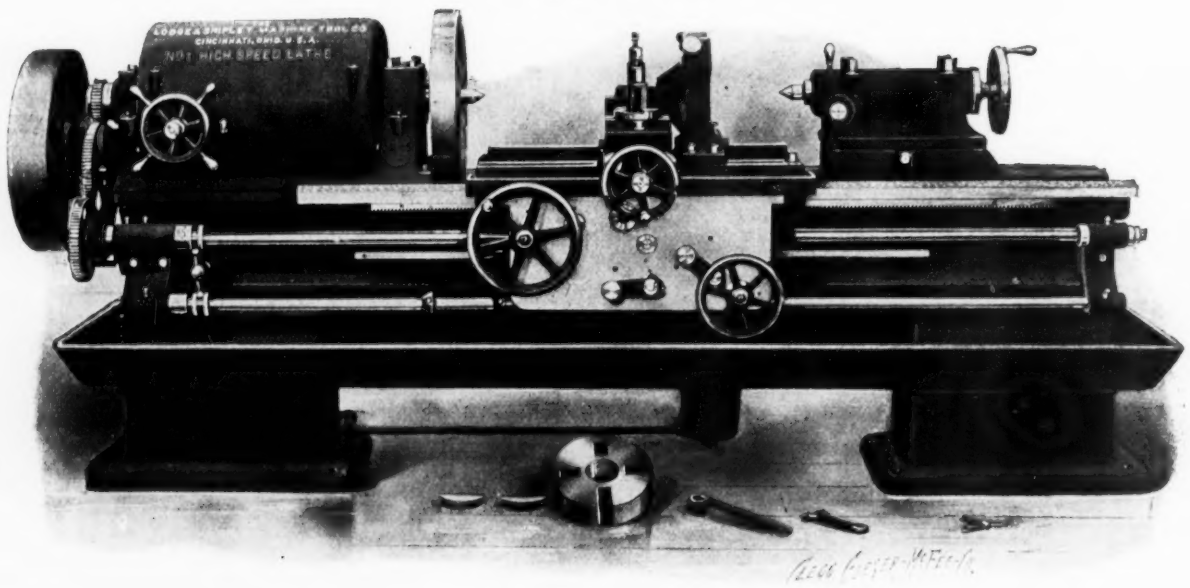


THIS LATHE CUT PIECE-WORK TIME FOR ONE CUSTOMER TO ONE-QUARTER OF HIS FORMER TIME

1/4

HE ORDERED THREE ADDITIONAL SIMILAR LATHES

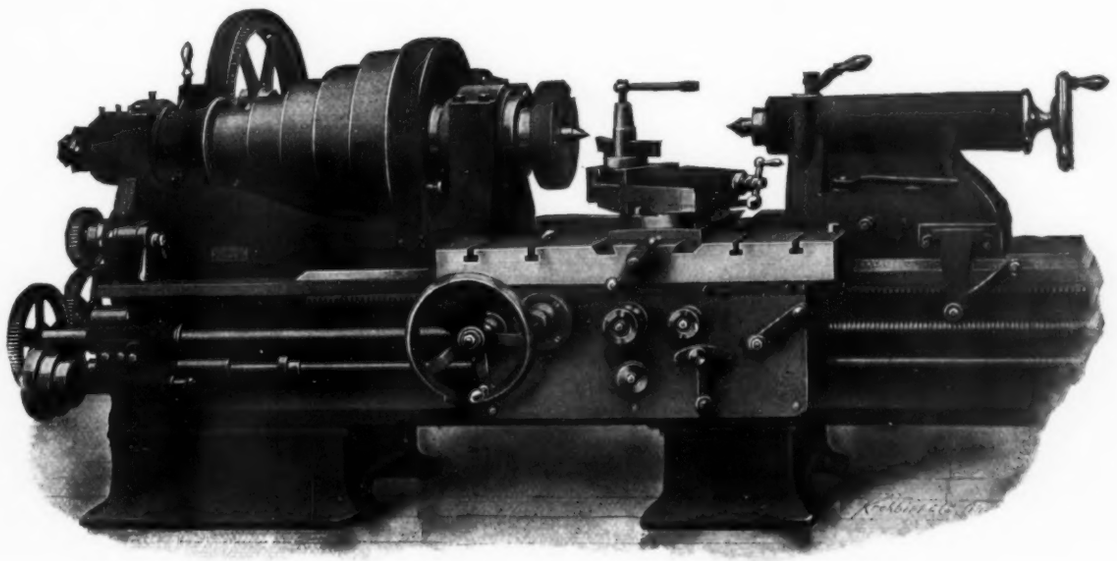
PATENTS APPLIED FOR



The Lodge & Shipley Machine Tool Co.

CINCINNATI, OHIO, U.S.A.

CANADIAN AGENTS—Williams & Wilson, Montreal. H. W. Petrie, Toronto.
EUROPEAN AGENTS—C. W. Burton, Griffiths & Co., London. Fenwick Freres, Paris. V. Lowener, Copenhagen. R. S. Stokvis & Zonen, Rotterdam. Adler & Eisenschitz, Milan.



32" Bradford Lathe

The full swing of this lathe is 32¾ inches over Ways, and 22⅞ inches over the Rest; has a 2 inch Hollow Spindle, and with 12 feet of bed takes 5 feet between centers. Beds can be supplied in any lengths.

It is a tool for general shop use, built for Heavy Duty, but its construction in this respect in no wise retards the workman in operating the Lathe, as the moveable parts are of easy access and so designed as to be readily applied.

Belt or Geared Feeds may be used, with reverse from the Apron. This Apron is of the Box Form, giving a bearing at each end of the short shafts in use there.

Send for Catalog of Lathes,
14 to 42 inch Swing. . . .

The Bradford Machine Tool Co.,

CINCINNATI, OHIO, U. S. A.

AGENTS—The Vandyck Churchill Co., New York and Philadelphia, Eastern Agents. Pacific Tool and Supply Co., San Francisco, Cal., Agents for Pacific Coast. FOREIGN AGENTS—Chas. Churchill & Co., Ltd., London, Birmingham, Manchester, Glasgow, Newcastle-on-Tyne. Schuchardt & Schutte, Berlin, Cologne, Vienna, St. Petersburg, Brussels, Stockholm, Paris, Milano, Bilbao.

BETTS MACHINE COMPANY,

Wilmington, Del., U.S.A.

Makers of

Heavy Machine Tools

of the

Most Advanced Types.

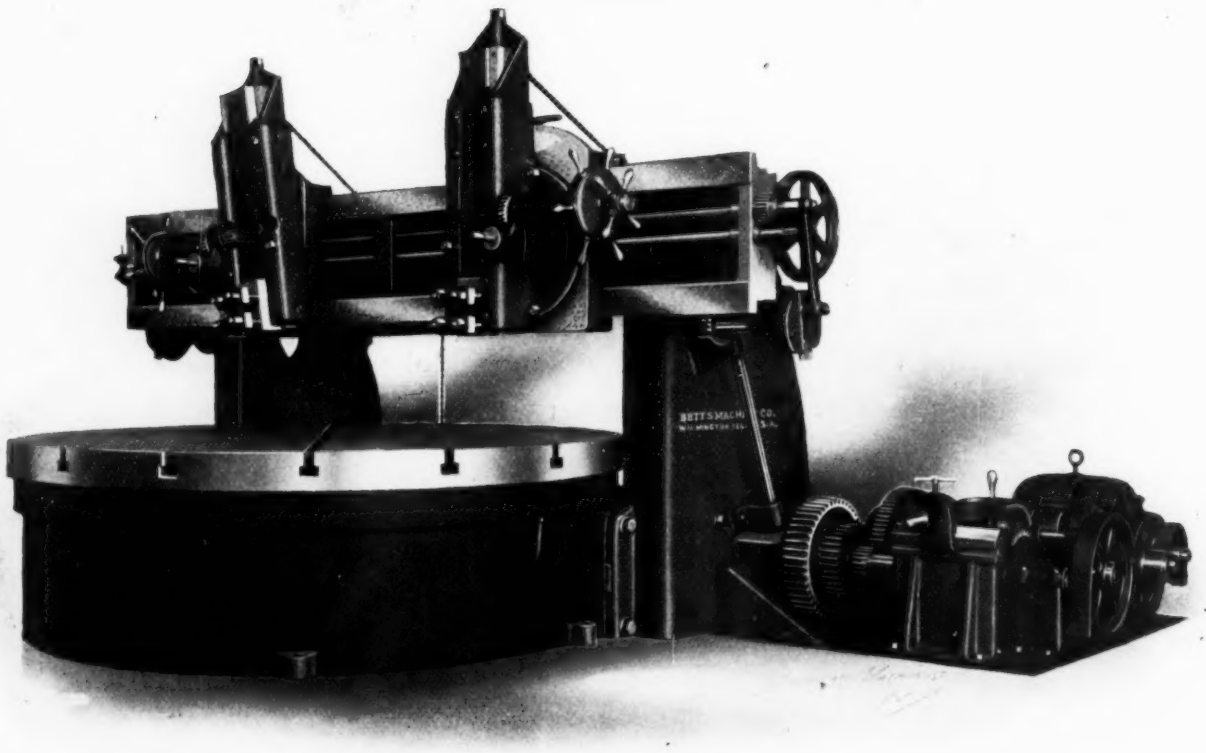


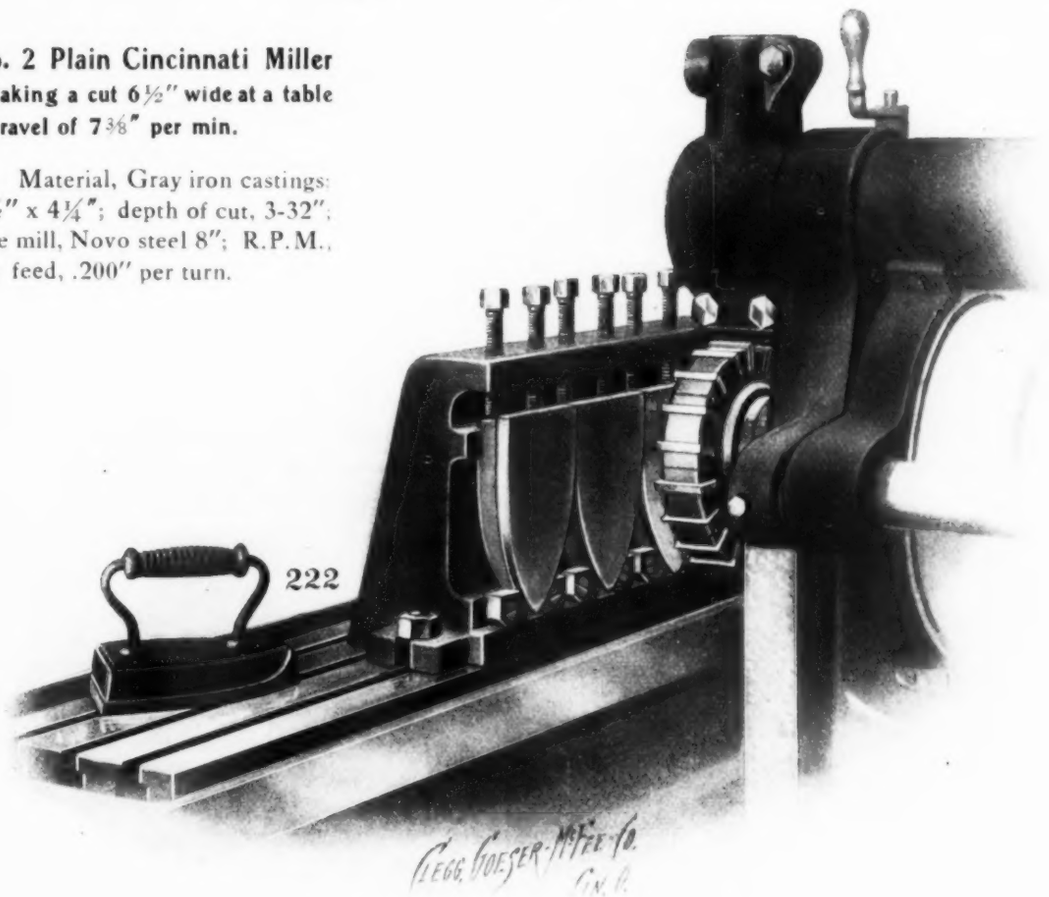
Illustration shows the 100-inch Tire Turning and Boring Mill, direct connected Motor Drive, as arranged for the Southern Pacific Company Shops at El Paso, Texas.

Vertical Boring and Turning Mills, Planers, Horizontal Boring Machines, Slotters, Etc.

More High Speed Milling

No. 2 Plain Cincinnati Miller taking a cut 6½" wide at a table travel of 7⅜" per min.

Material, Gray iron castings: 6½" x 4¼"; depth of cut, 3-32"; face mill, Novo steel 8"; R.P.M., 37; feed, .200" per turn.



Our No. 2 Plain Geared Feed Miller

fitted with a fixture and an 8" diameter Novo steel cutter, as illustrated, surfaces these sad irons in about ¾ of a minute each. That beats grinding, and there is very little polishing necessary afterward to bring them to the desired finish. A cut 6½" wide, at a table travel of 7⅜" per minute is good stiff work for a No. 2 Plain. It is another proof of the fitness of our machines for getting the best results out of high speed steels.

Let us submit time estimates with suggestions for milling your work.

WE ARE MILLING SPECIALISTS.

The Cincinnati Milling Machine Co.

Cincinnati, Ohio, U.S.A.

European Agents—Schuchardt & Schutte, Berlin, Cologne, Vienna, St. Petersburg, Brussels, Stockholm, Liege, Milan, Paris, Bilbao. Chas. Churchill & Co., London, Birmingham, Manchester, Newcastle-on-Tyne and Glasgow. Niles-Bement-Pond Co., 23 and 25 Victoria St., London, S. W.
Canadian Agents—Williams and Wilson, Montreal. H. W. Petrie, Toronto.

Mr. Works Manager:

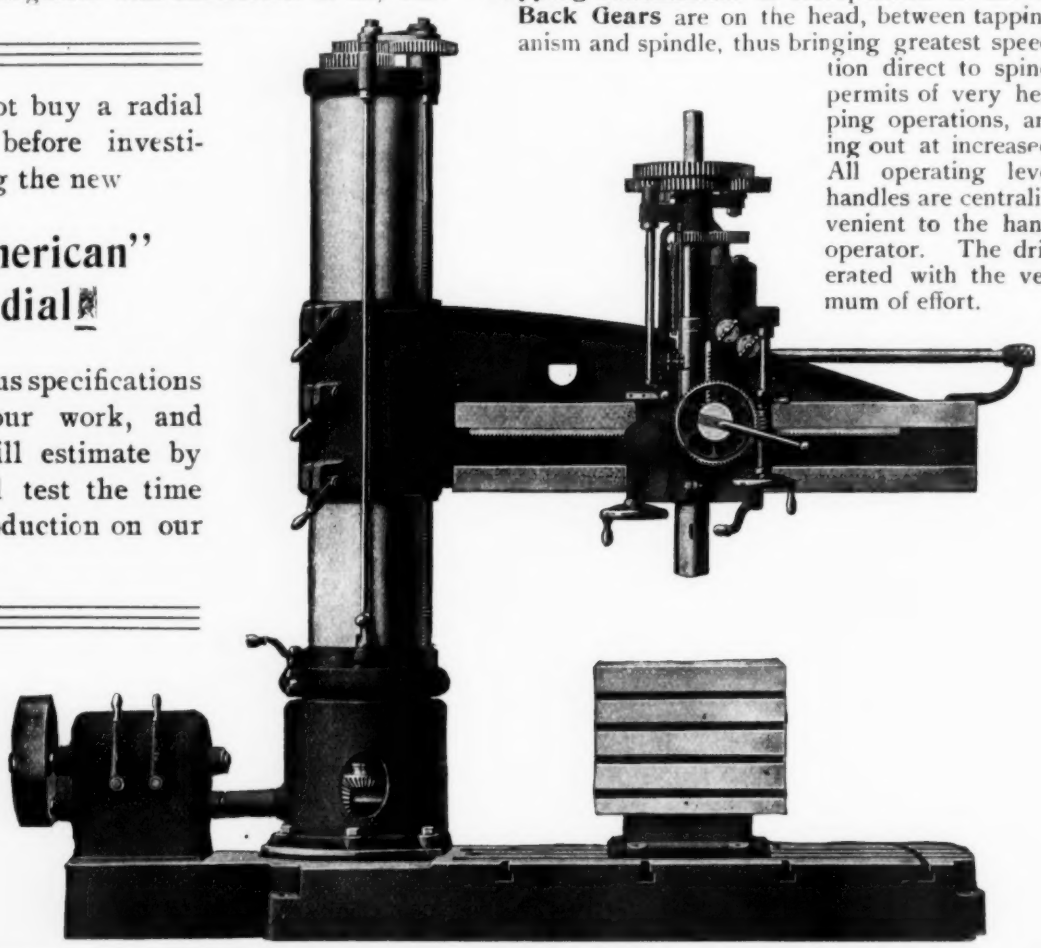
We have just produced an entirely new line of RADIAL DRILLS, 3′, 4′, 5′, 6′, 7′ arms, capable of using the new high speed twist drills to their limit of efficiency. We state, without hesitation, that they are absolutely the finest Radial Drills on the market to-day, based on the fact that in actual practice they have exhibited capacities for powerful and rapid drilling, surpassing all known existing records on other makes of radial drills. For instance: The "American" 4′ Plain Radial drills a series of 15 holes, ranging from 1-2 in. to 3 1-2 in. diameter through a 1 in. cast iron plate, in 25 minutes flat. This is, to our knowledge, the highest known record for rapid drilling.

"American" Radials are constructed throughout for resistance of heavy strains. **Spindle** has all geared feeds with eight changes; sixteen speed changes. Built with speed box or cone pulley, they being interchangeable with one another at any time. **Tapping Mechanism** is incorporated in the machine. **Back Gears** are on the head, between tapping mechanism and spindle, thus bringing greatest speed reduction direct to spindle; this permits of very heavy tapping operations, and backing out at increased speed. All operating levers and handles are centralized convenient to the hand of the operator. The drill is operated with the very minimum of effort.

Do not buy a radial drill before investigating the new

"American" Radial

Send us specifications of your work, and we will estimate by actual test the time of production on our drill.



THE AMERICAN TOOL WORKS CO.

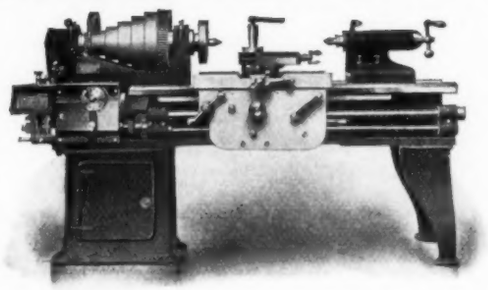
CINCINNATI, U. S. A.

Builders of Modern, High Standard

LATHES, PLANERS, SHAPERS, DRILLS.

SCHUMACHER & BOYE 18" PATENTED INSTANTANEOUS CHANGE GEAR ENGINE LATHE.

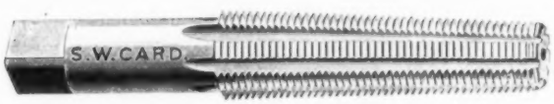
Any Pitch or Feed instantly obtainable, without removing a Gear, as shown in the Index:



TOP INDEX HANDLE IN HOLE	CUTS	FRONT INDEX HANDLE IN HOLE							
		1	2	3	4	5	6	7	8
1	Threads per Inch	2	2¼	2½	2¾	2⅞	3	3¼	3½
2	" " "	4	4½	5	5½	5¾	6	6½	7
3	" " "	8	9	10	11	11½	12	13	14
4	" " "	16	18	20	22	23	24	26	28
5	" " "	32	36	40	44	46	48	52	56

Feeds 4 Times Threads per Inch.
W. T. Emmes Patent, August 26, 1902, October 28, 1902.

SCHUMACHER & BOYE, ENGINE LATHES, 18" to 48" Swing, CINCINNATI, OHIO, U.S.A.



How do you judge taps—by the quality of their work and length of service? That's the test we want you to give Card's taps because they do better work, last longer—are better in every way than any other. A trial will convince you.

S. W. Card Mfg. Co., Mansfield, Mass., U. S. A.

New York Store, 123 Liberty Street.
Chas. Churchill & Co., London, Birmingham, Manchester and Glasgow.

A Safety Boiler

is the boiler fitted with this

Crosby-Standard Pop Safety Valve.

It opens promptly, closes promptly, and can always be counted on absolutely. A safety valve of this kind is worth more than a dozen accident policies and its first cost is its total cost. Have you our Catalog?

CROSBY STEAM GAGE & VALVE COMP'Y,
Office and Works, BOSTON, MASS.

93-97 Oliver Street, Boston, Mass. 78 John Street, New York.
21 and 23 W. Lake St., Chicago. 147 Queen Victoria St., London.

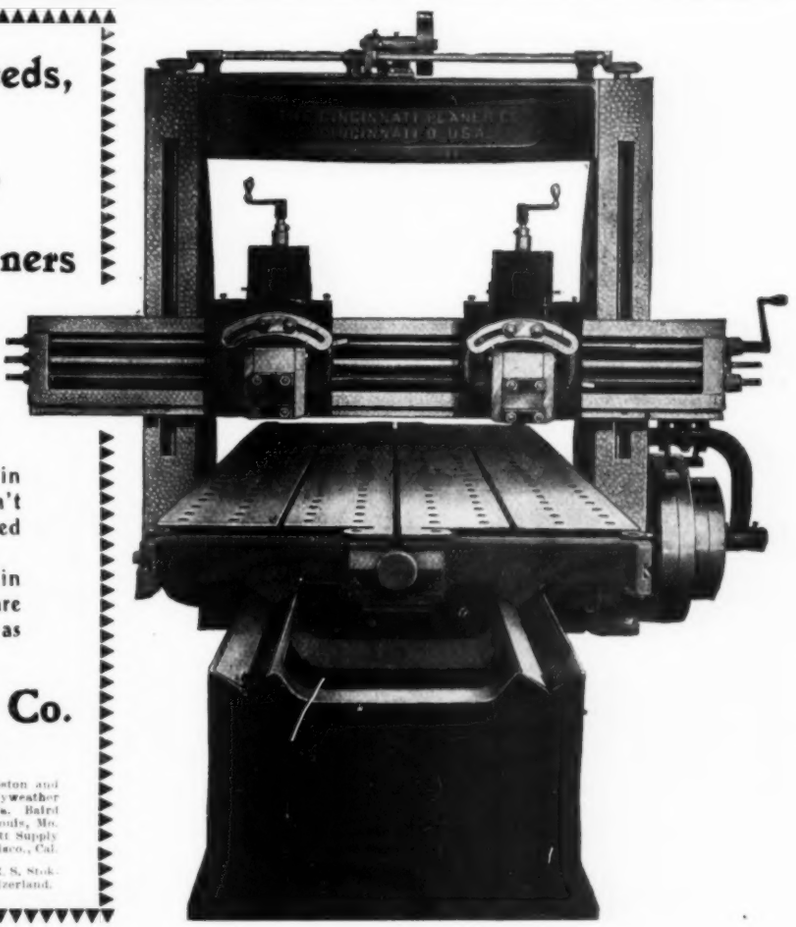
Two, Four or Six Speeds,

Are Possible With

"CINCINNATI" Variable Speed Planers

and these cutting speeds can be divided up to suit your work. You may want to run as low as fifteen feet, or perhaps as high as eighty feet. You can get both with the "Cincinnati," and you don't have to stop the machine or lose any time in making the changes either. You won't find many people buying One Speed Planers now.

Our Variable Speed Planers are made in sizes from 24 in. to 84 in., and are equipped with belt or motor drive, as desired. Want a stray Cat?



The Cincinnati Planer Co.

Cincinnati, Ohio, U.S.A.

Domestic Agents.—Prentiss Tool & Supply Co., New York, Boston and Buffalo. Marshall & Huschart Machinery Co., Chicago. Motch & Merryweather Machinery Co., Cleveland, Ohio. Mr. W. E. Shipley, Philadelphia, Pa. Baird Machinery Co., Pittsburg, Pa. W. R. Colcord Machinery Co., St. Louis, Mo. McArdle-Parker Machinery Co., New Orleans and Birmingham. Scott Supply & Tool Co., Denver, Colo. Harron, Rickard & McCone, San Francisco, Cal.

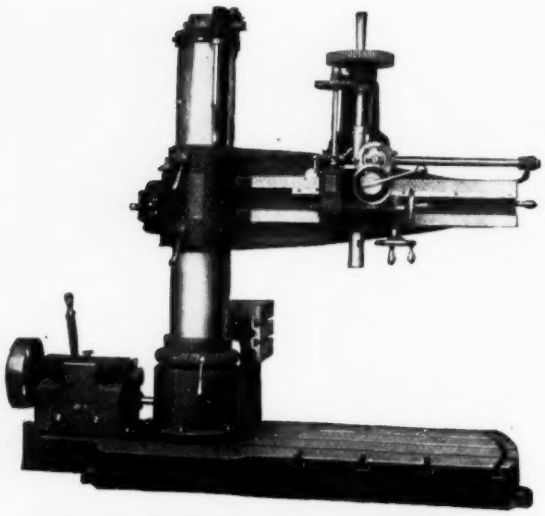
H. W. Petrie, Toronto, Canada. Williams & Wilson, Montreal. R. S. Stokvis & Zonen, Rotterdam, Holland. J. Lambercier & Co., Geneva, Switzerland.

LITTLE GAIN

The Bickford Drill and Tool Company,

CINCINNATI, OHIO.

FOREIGN AGENTS—Schuchardt & Schutte, Berlin, Vienna, Cologne, St. Petersburg, Brussels, Stockholm, Paris, Liege, Milan, Bilbao and New York. Charles Churchill & Co., Ltd., London, Birmingham, Manchester, Newcastle-on-Tyne and Glasgow. F. W. Horne, Yokohama, Japan. H. W. Petrie, Toronto, Canada. Williams & Wilson, Montreal, Canada.



THE BICKFORD RADIAL.

88A

Is experienced by having a wide range and a great variety of speeds and feeds unless any speed or feed can be obtained instantly and with ease.

The operator will seldom, if ever, make use of an intermediate feed if he is put to the inconvenience — meaning delay — of shifting a feed belt or tugging at a pull pin every time he changes drills.

It is highly important, therefore, that the feeding mechanism be so arranged that any feed with which the machine is provided can be obtained instantly. The New Bickford Radial is fitted with a feed box that gives instantly any one of the eight feeds with which the machine is provided.

We find after careful experiment, the speeds on a Radial Drill should range in geometrical progression and in order that the machine be suitable for drilling in a great variety of work, number not less than 16.

The New Bickford Radial has 16 speeds ranging in geometrical progression from 16 to 267 revolutions per minute, any one of which is instantly available.

CORROBORATIVE DETAIL

Being extracts from our folder

BOUQUETS,

Which folder may be had for the asking.

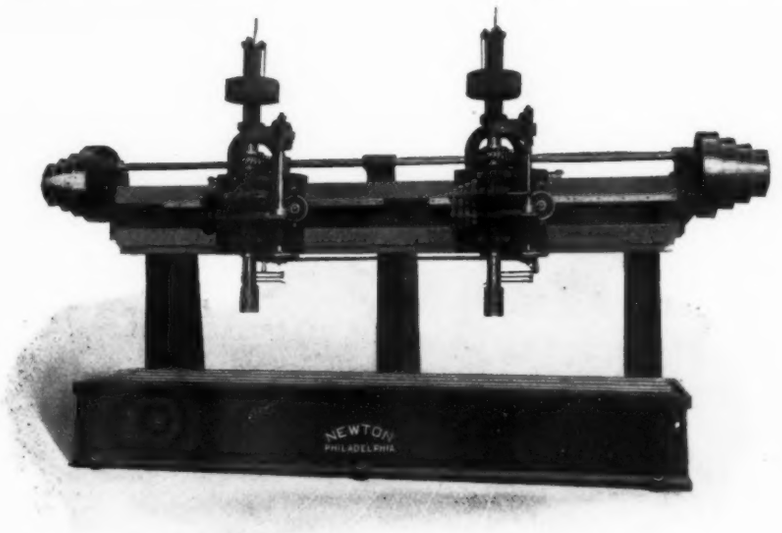
Wilmington, Del.

We would say that we are well satisfied with both quality and quantity of work turned out; we can do fully one-third more general work on this machine than with any other single machine we have, most of this no doubt being due to the ease and rapidity with which changes of feed and speed can be obtained.

Very truly yours,

BETTS MACHINE CO.,

Wm. Betts President.



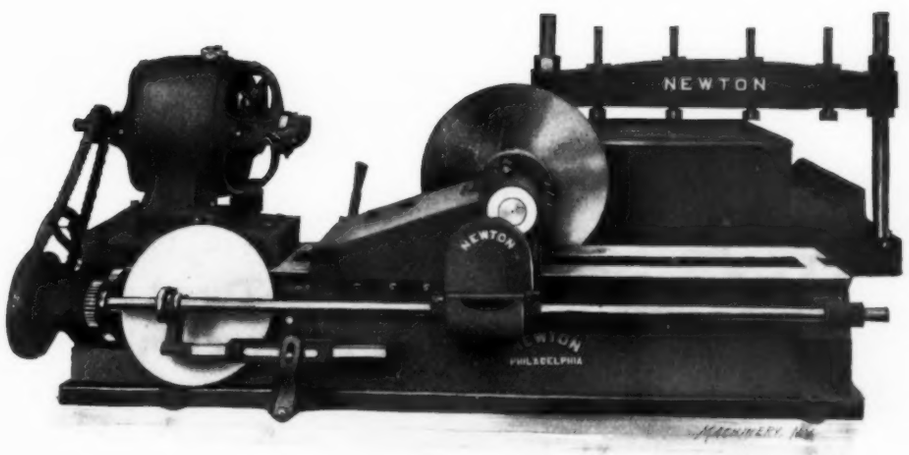
Rotary Planing and Milling Machines.

Slotting Machines.

Heavy Portable and Special Tools.

No. 1 Locomotive Rod Drilling Machine.

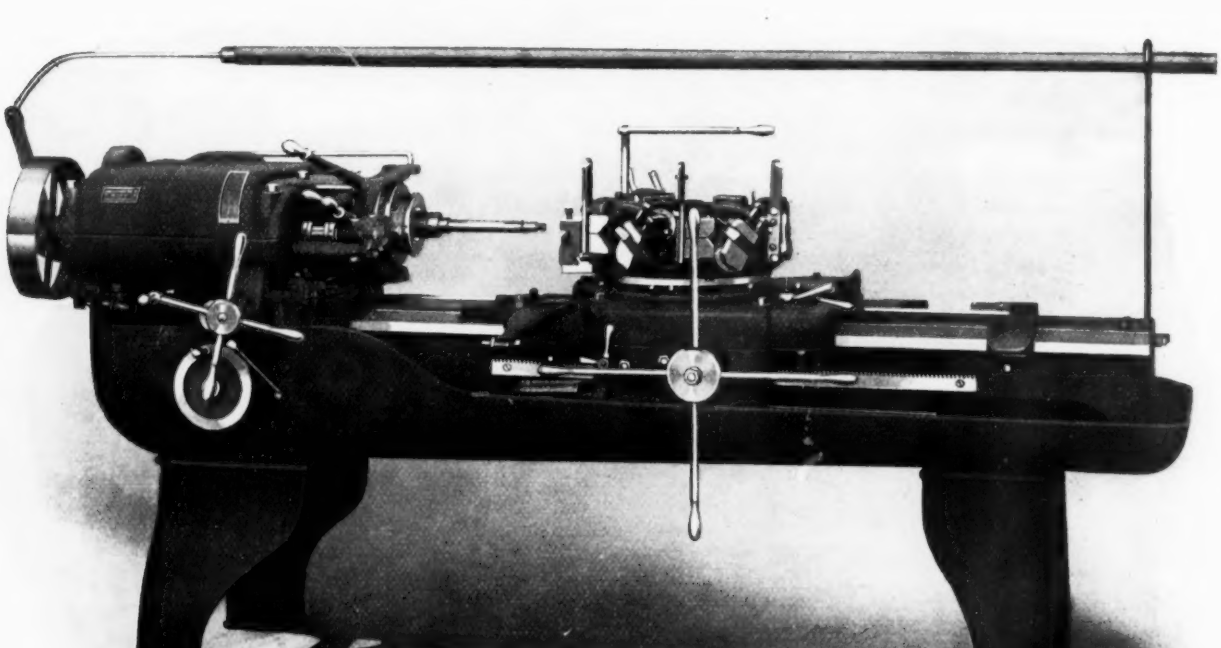
NEWTON



No. 3 Combination Cold Saw Cutting Off Machine.

Newton Machine Tool Works, Inc.,

Philadelphia, U. S. A.



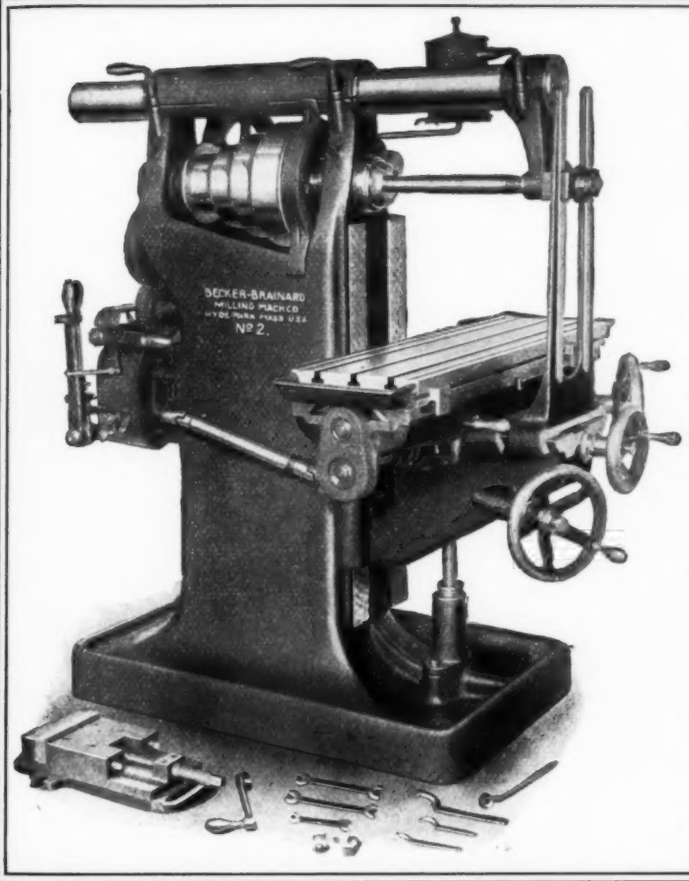
The "Flat Turret" Lathe

Constant Speed Drive.
Takes Chucking Work.
Takes Work from the Rod or Bar.
Cross Feeding Head Stock.
Head Works run in Oil.
Head Stock has 10 stops, Turret 12 stops.
Saves from 50% to 80% over other ways.
Comes to you carrying a Specific Guarantee as to Performance in your shop.

Jones & Lamson Machine Co.,

Springfield, Vt., and 97 Queen Victoria St., London, E. C.

Germany, Holland, Belgium, Switzerland and Austria-Hungary: M. Koyemann, Charlottenstrasse, 112, Dusseldorf, Germany.
France and Spain: Ph. Bonvillain, 6, Rue Blanche, 6, Paris, France. Italy: Adler & Eisenschitz, Milan.



GEAR FEED MILLING MACHINE ADVANTAGES!

Positive feed permitting unusually heavy cuts to be taken.

Range of twenty feeds to each spindle speed instantly secured by means of lever.

Ample power and speed for using high speed cutters to advantage.

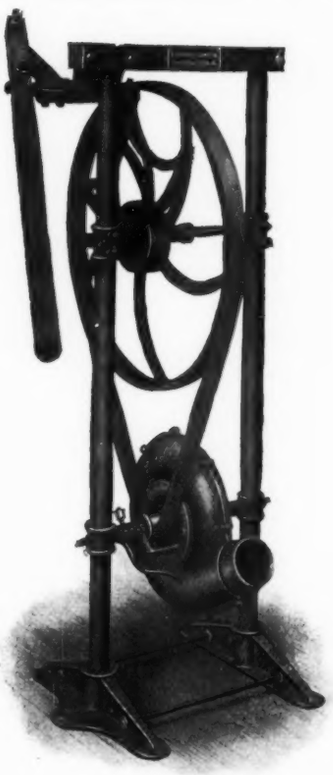
Much greater output per each machine.

Write for latest Catalogue.

BECKER-BRAINARD MILLING MACHINE CO.

HYDE PARK, MASS.

Branch Office, The Bourse, Philadelphia, Pa. 246



STURTEVANT HAND BLOWERS

of improved type for blowing forges of all kinds. Used also as portable ventilating apparatus. We make complete

FORGE SHOP EQUIPMENTS

Including

Forges, Blowers, Exhausters, Galvanized Iron Piping, Etc.

B. F. STURTEVANT CO.

BOSTON, MASS.

General Office and Works, Hyde Park, Mass.

New York, Philadelphia, Chicago, London.

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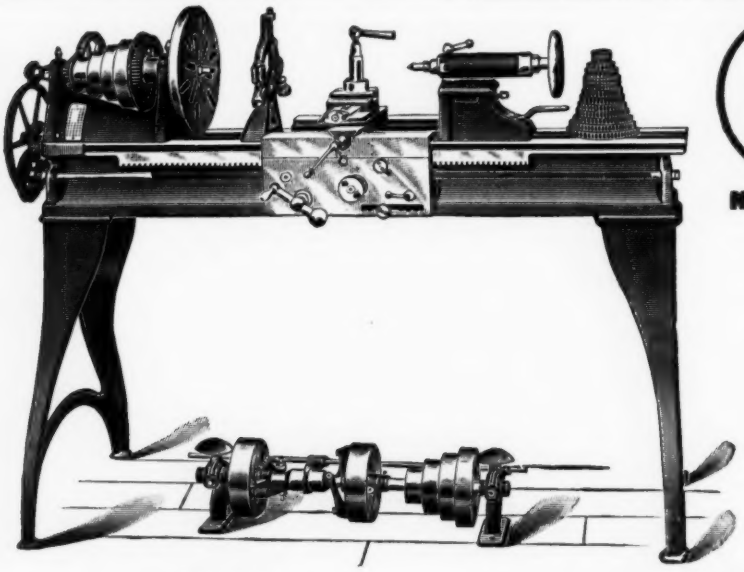


TRADE W.F. B J.G MARK

"ORIGINAL BARNES" LATHES.

9 in. to 13 in. Swing.

No. 13. 13-in. Swing Lathe.

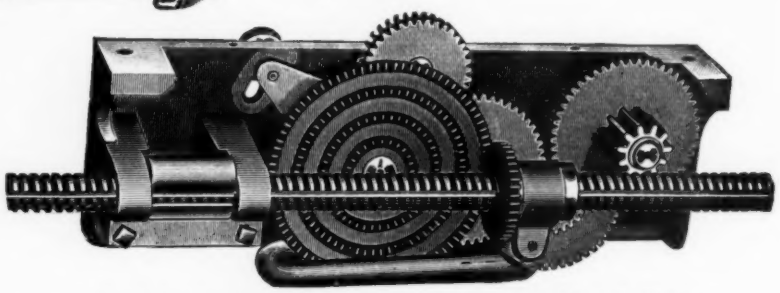
Look at the positive feed in the carriage; consider the variety of feeds without change of gears; a strong feed and not equaled by any lathe of its size; has compound rest and automatic cross feed; has hollow spindle and set-over tail stock; is back geared and cuts right or left-hand screws. Every gear is cut from solid metal; the best of workmanship, accurate and practical, strong and convenient in operating.

PRICES:

With Countershaft, 5 ft. Bed	$157.00
6 " "	167.00
7 " "	177.00
8 " "	187.00
10 " "	207.00

With Foot Power $5.00 less.

SEND FOR LATHE CATALOG.



Feed Arrangement in Tool Carriage. Pat. May 6, 1902.

SOLE MANUFACTURERS,

W. F. & JNO. BARNES CO., 1995 Ruby St., (Established 1872) Rockford, Ill.

Pipe Threading Machines.

NEW DESIGNS JUST COMPLETED WITH MANY IMPROVEMENTS

The Stoever Foundry & Mfg. Co.,
MYERSTOWN, PA.

No Lost Diamonds—

when you use the

Semi-Dimond

Emery Wheel Dresser.

A steel tube filled with the hardest abrasive known to science.

NET PRICE LIST:

8", $3.00 10", $3.50
12", $4.00

Money refunded after 15 days' trial if not satisfactory. No machine shop can afford to be without one.

International Specialty Co.,
353 Holden Ave., Detroit, Mich.

We make fuel gas plants too.

Get the Modern Gas Forge.

It does the work cleaner, better, cheaper and quicker than the old way. Here is the

Gas Forge No. 2

which is designed for Lathe and Planer Tools, Short Drills, Taps and Reamers, or similar work.

It has an entrance 6 in. wide, by 3 in. high, with a depth of 6 in., and heats bars up to 2 in. sq. x 6 in. long.

The full description is in "High Speed Steel Supplement No. 2." Ask for it.

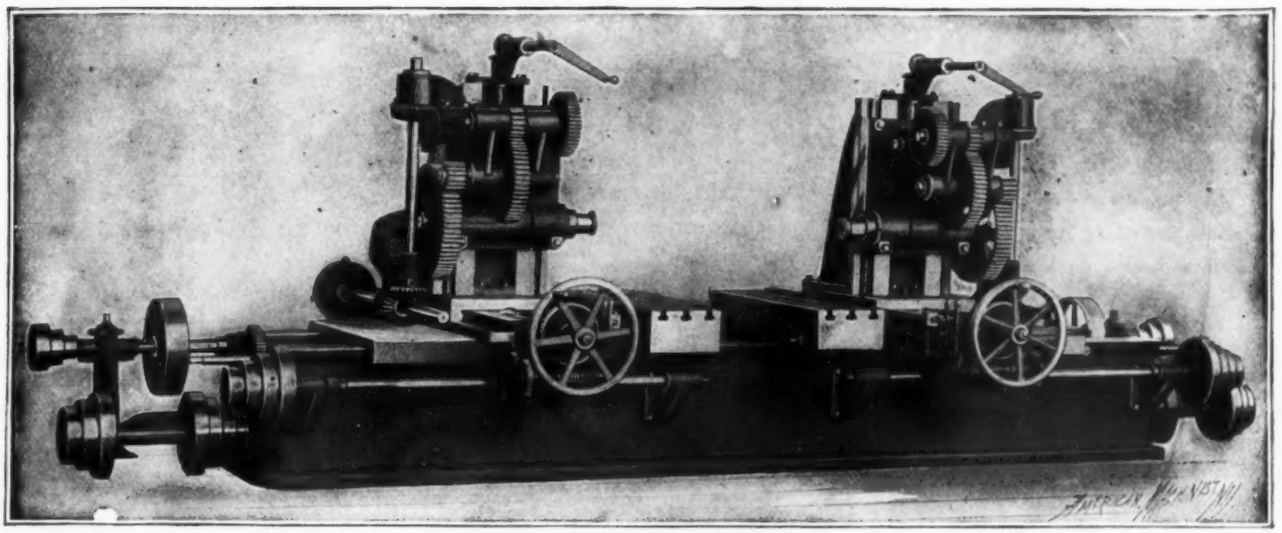
American Gas Furnace Co.,

23 John Street, New York.

Chas. Churchill & Co., London, Birmingham, Manchester and Glasgow. Schuchardt & Schutte, Berlin, Cologne, Vienna, St. Petersburg. H. Glaenzer & Perreaud, Paris.

Have You Seen Our No. 4 Duplex Milling Machine? Here It Is.

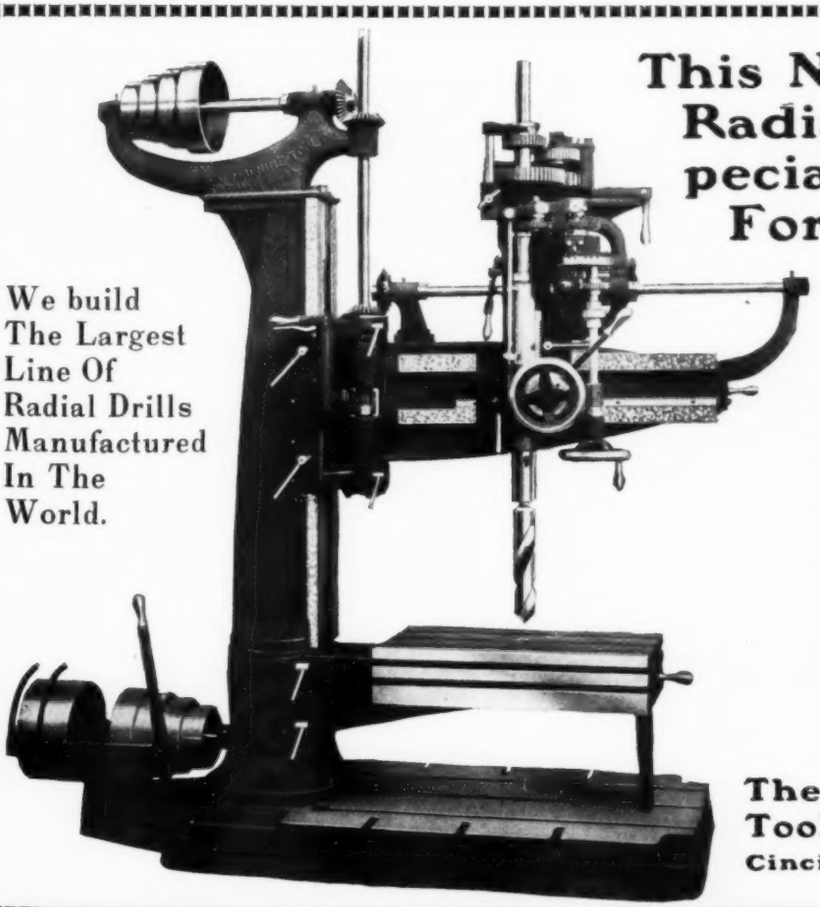
(Code Word Chastening).



This is about the very latest thing in the milling machine line and naturally about the very best. The machine is unusually efficient and many of its details are exceedingly interesting. The columns of this tool are arranged to feed the cutters along the work while the work itself is held stationary on a pair of tables. This is a good idea and works well. Our catalog shows our other styles. Send for it.

The Beaman & Smith Co., - Providence, R. I., U.S.A.

England: Chas. Churchill & Co., London. France: Fenwick Freres & Co., Paris.



We build The Largest Line Of Radial Drills Manufactured In The World.

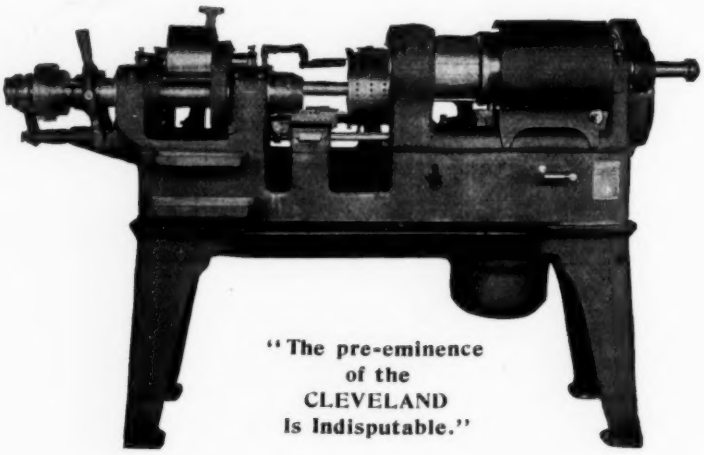
This New Standard Radial Drill Is Especially Designed For High Speed Steels.

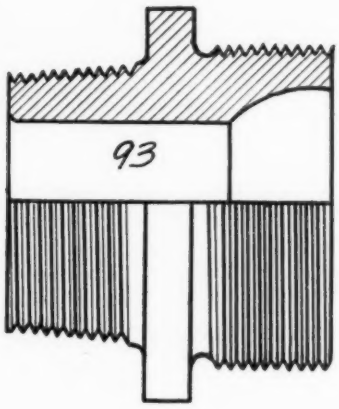
If you attempt to speed up and "Push" an ordinary drill for high speed steel, you will ruin the machine and not get the results after all. High speed steel requires high speed machines. The Fosdick New Standard Radial Drill is a high speed machine and will run high speed steel to the limit. The full capacity is 3" hole through solid cast iron, 2½" hole through solid steel and it will pull a 2½" tap through cast iron.
Full particulars on request.

The Fosdick Machine Tool Company,
Cincinnati, Ohio, U. S. A.

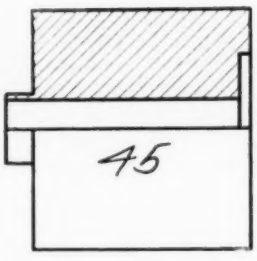
We will continue giving Labor Costs in this paper next year.

Watch them. Figure out what it costs you for labor on similar pieces of work and compare figures. You'll find them mighty interesting.





Piece No. 93, material Malleable Iron, made on a 2¼" Cleveland Automatic Turret Machine, two operations, using our Tilting Magazine, drawing full size, time of all operations for completing this piece 5 minutes, actual cost of labor from 5 to 6 mills, depending on the number of Machines operated by one man.



Piece No. 45, material Machine Steel Bar, made on a 2" Cleveland Automatic Turret Machine, drawing full size, time of all operations for completing this piece 5 minutes, actual cost of labor from 5 to 6 mills, depending on the number of Machines operated by one man.

Cleveland Automatic Machine Co.

Cleveland, Ohio, U.S.A.

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CANADIAN REPRESENTATIVE: H. W. Petrie, Toronto, Ont.
FOREIGN BRANCHES: Chas. Churchill & Co., London, Manchester, Birmingham, Newcastle-on-Tyne and Glasgow.
Messrs. Schuchardt & Schutte, Berlin, Vienna, Brussels, Cologne, St. Petersburg and Stockholm. Romain Talbot, Paris.

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Six 1 H.P. Drives, operating Heading Machines, Garland Nut and Rivet Company, Pittsburg, Pa.

An excellent example of Renold Silent Chain in multiple drives. The compact arrangement, very short centres, saving of space, and high percentage of efficiency—these are only possible to the flexibility and positive action of Renold Silent Chain. Booklet "F" is a necessity to everyone interested in power transmission. Write for it.

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Ask for a copy of "File Filosophy," it contains many good, practical suggestions on using files.

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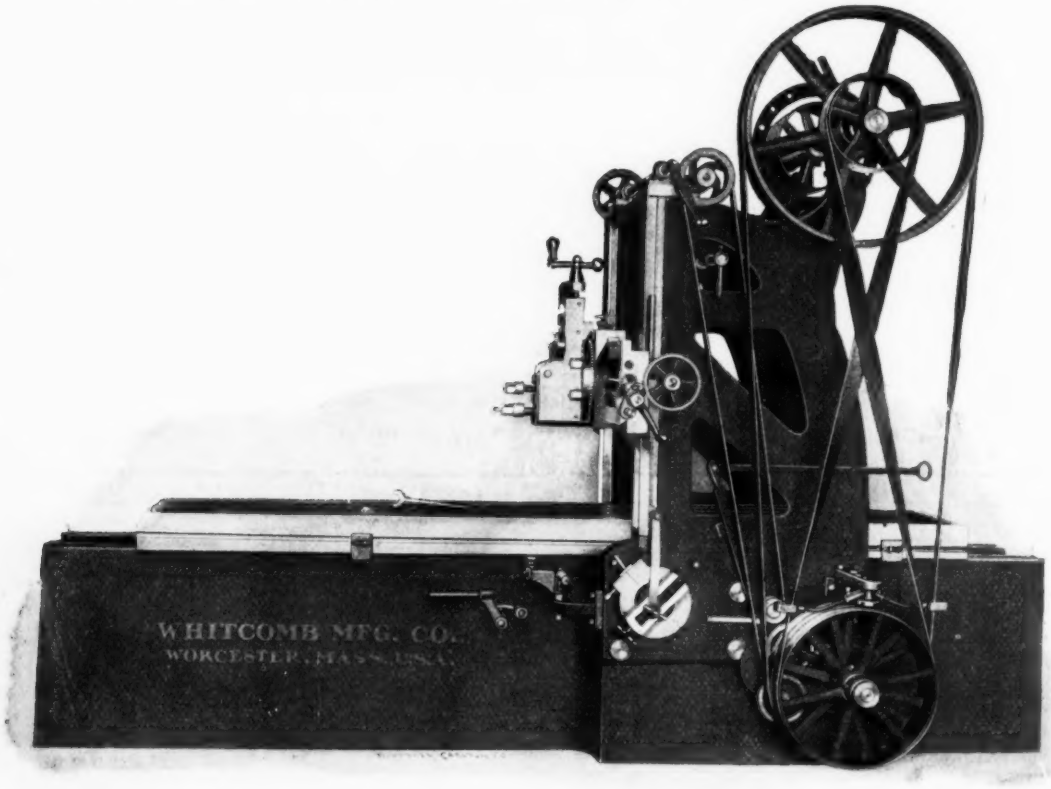
High cutting speed and quick return, all without noise and rattle. They will stand speeds that would ruin a full geared planer. All shafts and gears can be easily removed and replaced in a few minutes. The second-belt is automatically kept at proper tension.



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With countershaft on housing. Can be furnished with two speed countershafts or any arrangement of motor drive.

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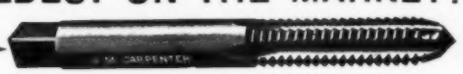

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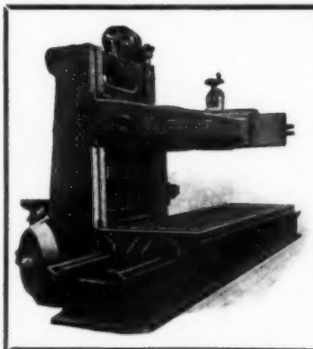

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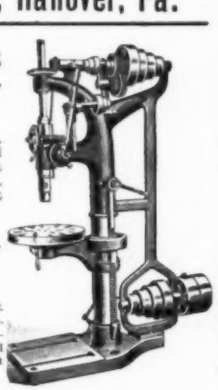

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Smaller Sizes Proportionately Easy.
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Our Specialty, Internal Grinding Only.

has an internal grinding capacity of 0 to 6 inches and of 0 to 6 inches in length.

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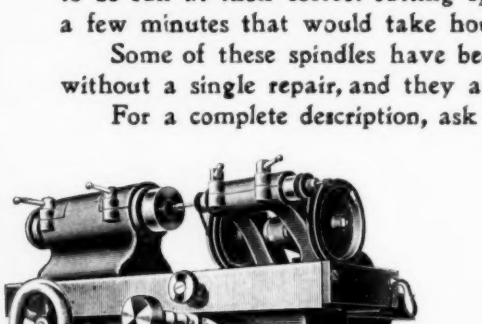

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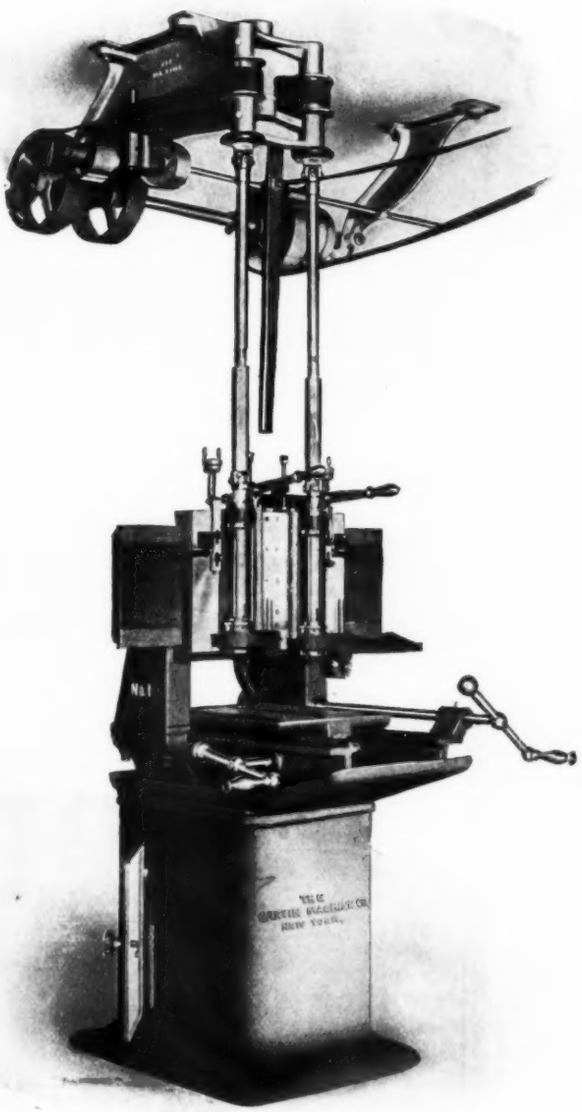

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Large handles giving perfect control and easiest motion.

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FULL STOCK OF ALL SIZES CARRIED.

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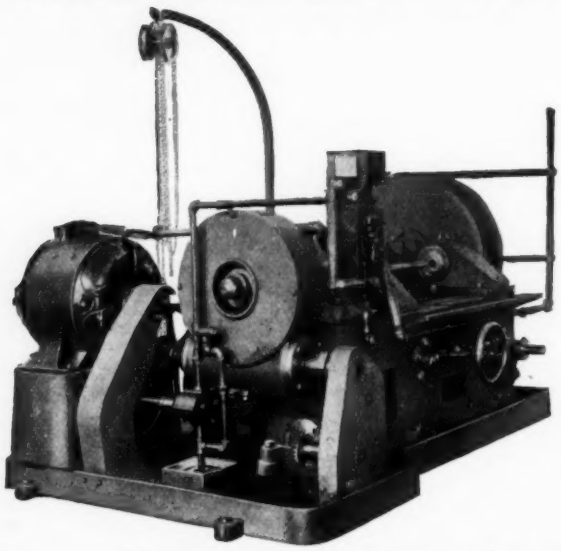

General Electric 15 H. P., 1200 R.P.M., Shunt Motor driving a Niles Tool Company's Milling Machine.

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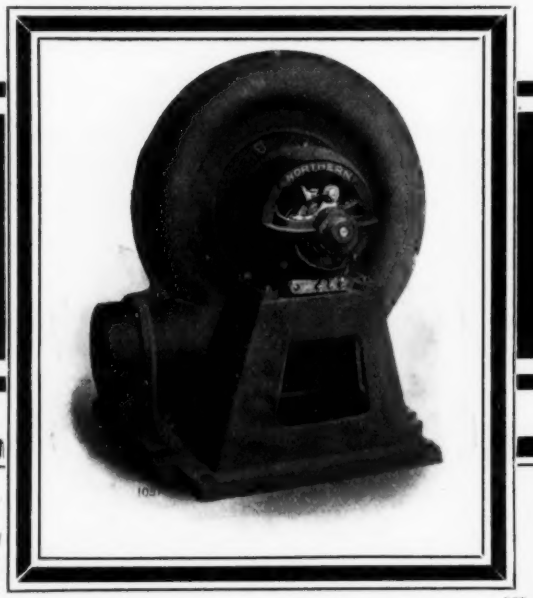

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An application of Northern Motors in shop work that saves money by saving labor—power.

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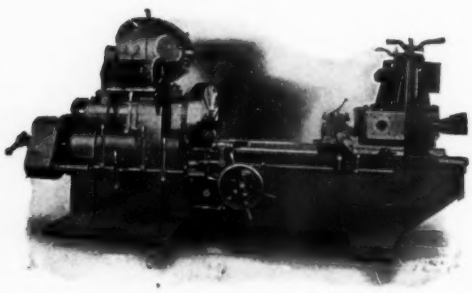

Conradson Automatic Turret Lathe driven by two Crocker-Wheeler Form I motors. A size 10 drives main spindle and a size 3 revolves turret.

We offer our customers the services of DODGE & DAY, Engineers, experts in shop equipment.

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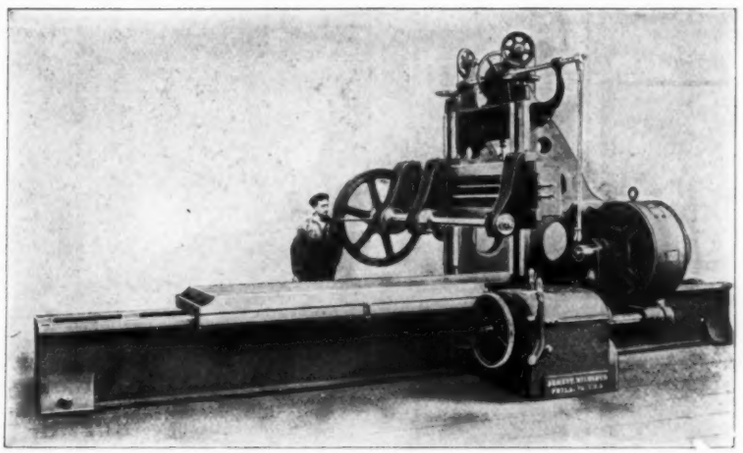
Increases Production—Decreases Costs.



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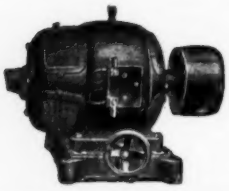

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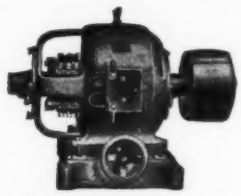

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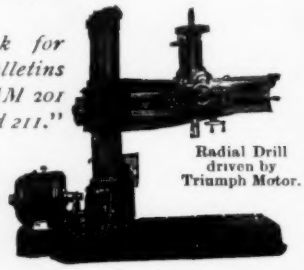

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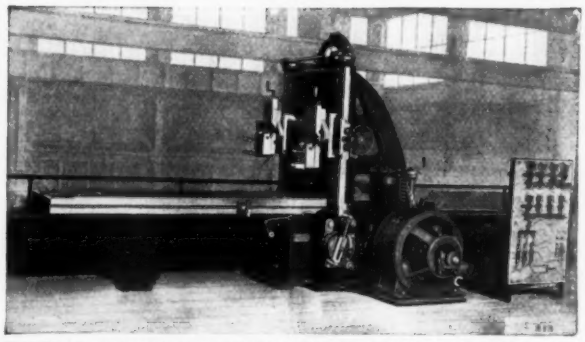

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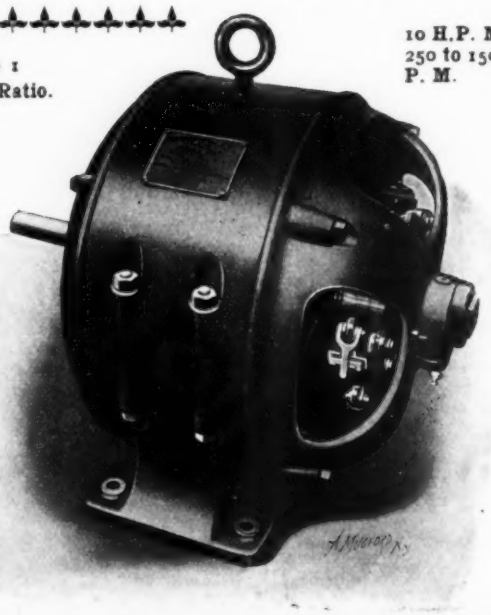

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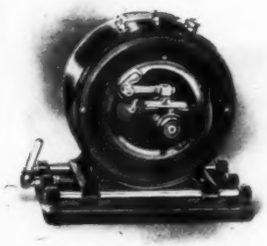

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We are constantly adding new frames to our line of small motors, which are being designed to fit certain dimensions, running qualities, or other peculiarities of the driven machines. It is impossible to list these frames, but we will be pleased to hear from makers of motor driven machines, and may be able to assist in solving their motor problems.

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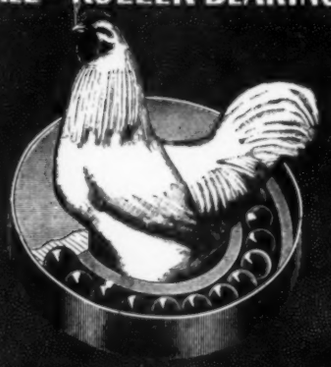

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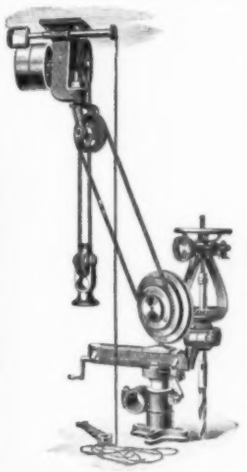

Are as easily placed as a ratchet brace and will drill at any angle, in any position at any distance and in any direction from the source of power.

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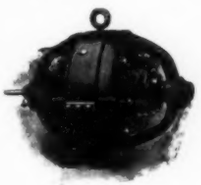

for machine tools requiring a very wide range of speed variation—say 6 to 1, is attained through the use of

"C & C" Type "S"

direct-current Double Commutator Motors operating on a standard two-wire system. All speed gradations effected by varying the field strength of the motor, with the separate armature windings thrown in series or parallel.

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The Simplest and Most Efficient System Ever Devised

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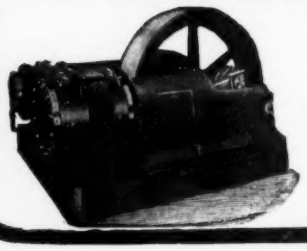

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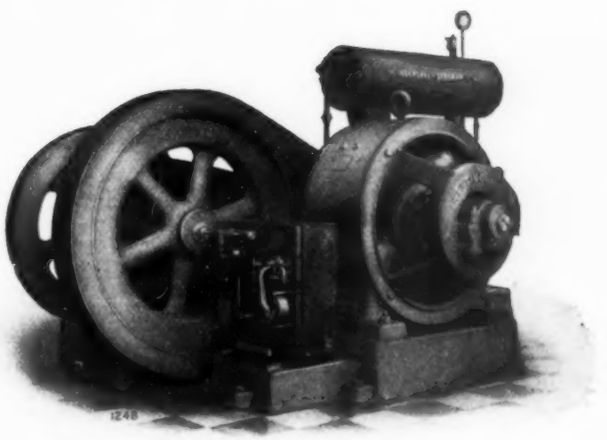

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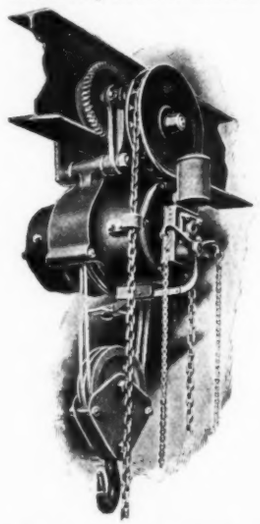

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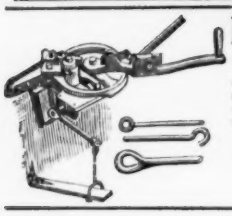

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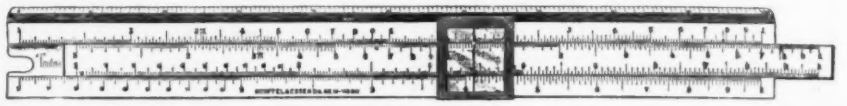

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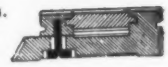

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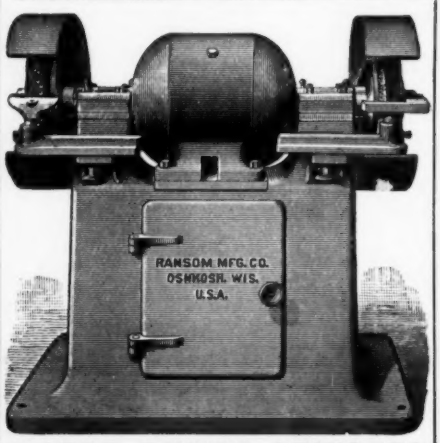

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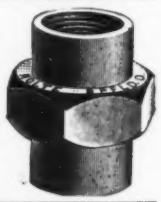

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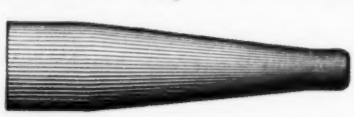

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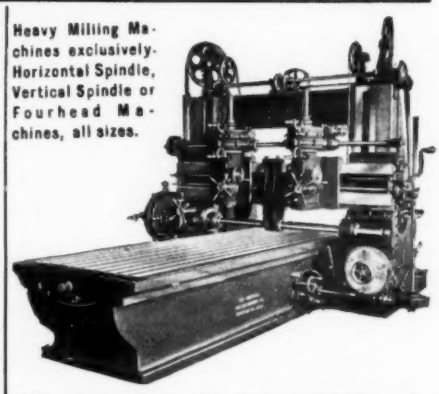

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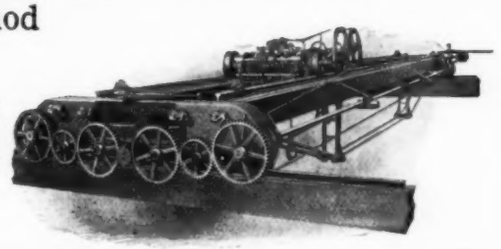

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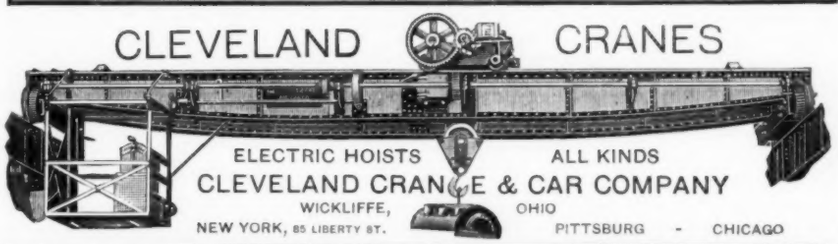

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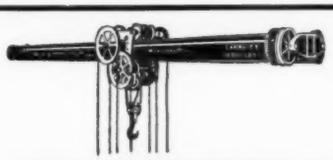

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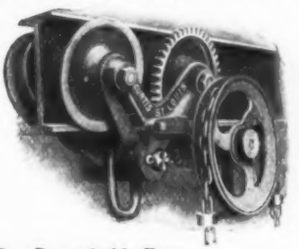

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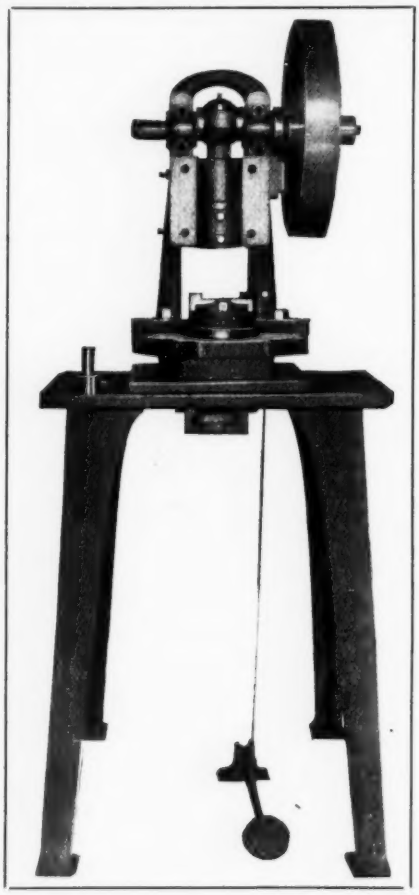

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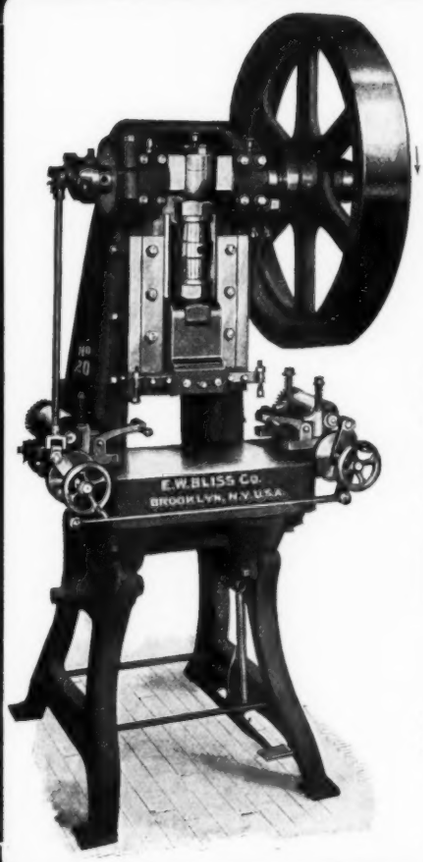

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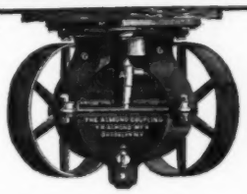

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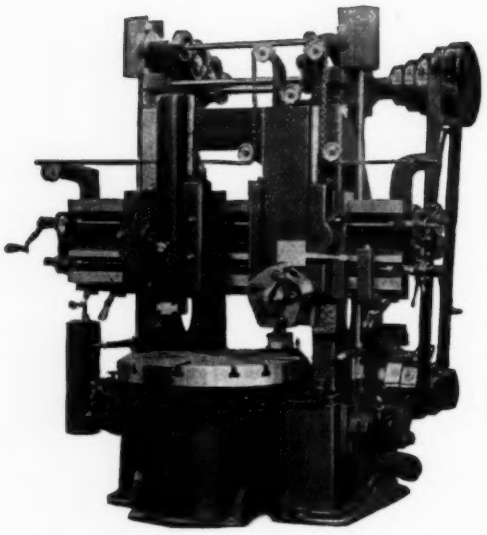

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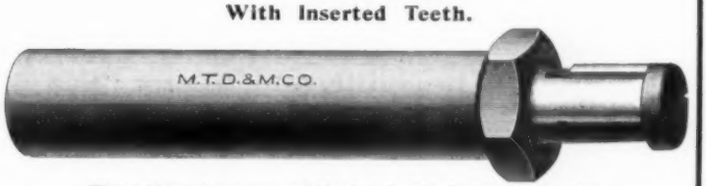

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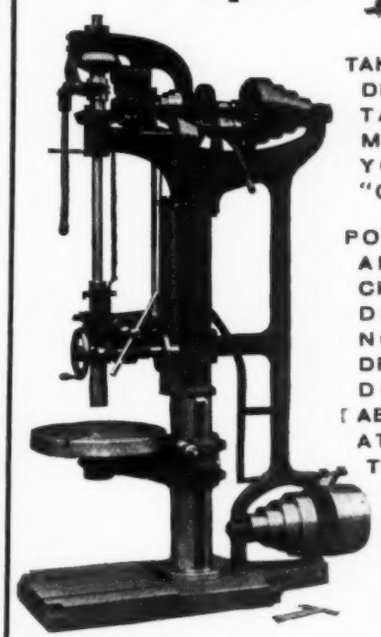

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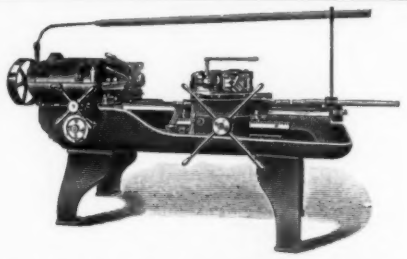

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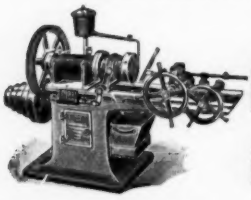

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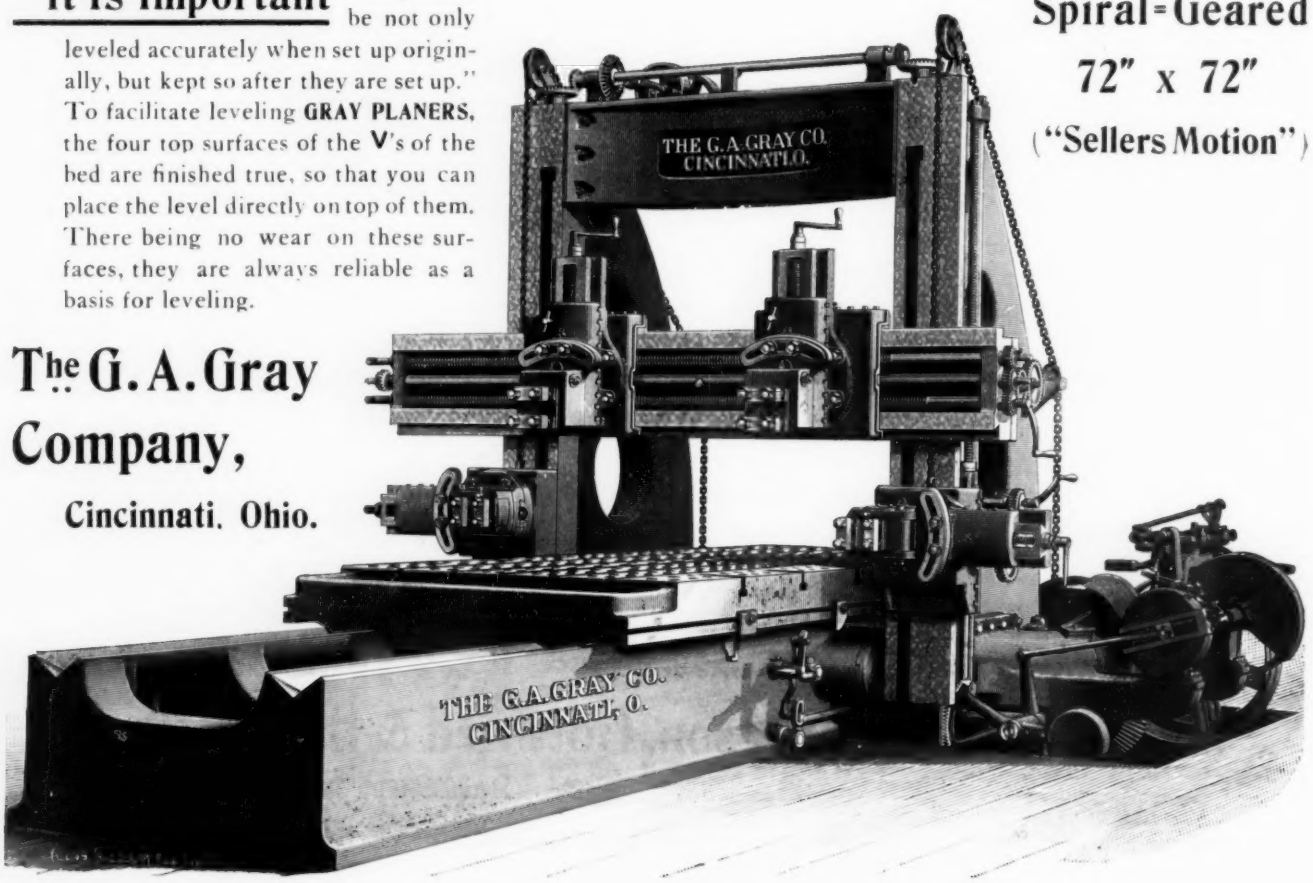


Sweeping a Mold for a Split Flywheel.

BY R. H. PALMER.

Fig. 1 shows the wheel ready for splitting, and Fig. 2 shows the face of one half after the splitting, with the cored holes *A* for bolting together and the dirt-

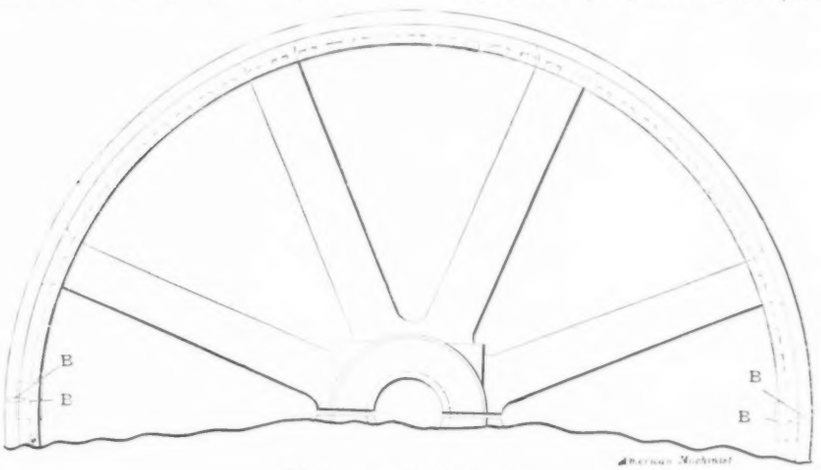


FIG. 1. A SPLIT FLYWHEEL.

catcher *B*, which is to be cut off in the lathe.

Spindle *A*, Fig. 3, is lowered into its seat *B*, set collar *C* is located and fastened, finger *D* is placed on the spindle, resting on collar *C*, and is tightened on to the spindle. Strike *E* is fastened to the finger by bolts *F* and has on it piece *H*, which is to sweep the seating in which the core is set, which is to form the bottom of the hub, while the rest of *E* is used to sweep a firm, level bed. Castings *J*, of which there are four, are bedded in at the proper distance from the center for the cheek or curb to rest on. The castings are shaped for the ends toward the spindle to be down below the floor some distance to allow plenty of sand to come between them and the casting when the iron flows over this end.

These castings *J J* are plates, better seen in Fig. 5. These plates take the strain when the cheek is closed on and keep it from crushing.

Strike *E* is now removed, and the cheek casing or curb, Fig. 4, is lowered around the spindle, resting on the joint and on plates *J*. Stakes *A*, Fig. 4, are driven down and against ears *B*, which are bolted

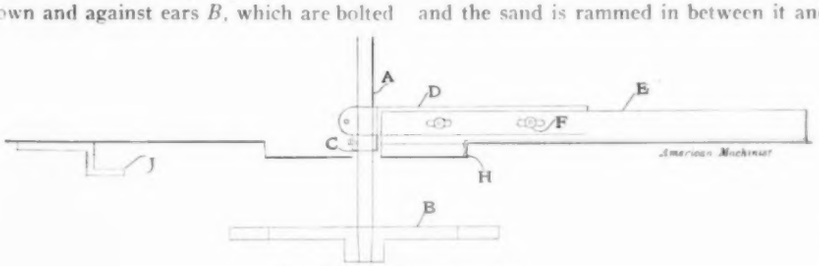


FIG. 3. SWEEPING THE BED.

to the cheek. These ears are to guide the cheek off and on when raised or lowered. The cheek or curb is made in four pieces and bolted together as at *C*, *C*, *C*.

At *D*, Fig. 4 is seen an elongated hole. On the inside of the cheek and extending across this hole up to line *E* is a piece of sheet iron. In case the wheel to be made is not wide enough on the face to require the full depth of the cheek, the pieces of sheet iron can be moved up or down, thus arranging for any depth of cheek required and allowing the overflow to pass thru these holes into basins prepared, where it is easily broken up when set. In this way as much or as little riser can be left on the casting as may be desired. The cheek is removed and near the bottom is clay-washed, as the casting comes quite close. It is then replaced. Parting sand is used, and a row of gaggers F is set around.

A rough former *X*, Fig. 6, has been made, some 5 inches in thickness at the ends, and of a hight equal to the face of the wheel, the outside and the inside corresponding to the outside and inside circles of the wheel. This former is now set the required distance from the center and the sand is rammed in between it and the cheek, the joint being made at the top and a row of vents run down within some 1½ inches of face, as shown at *J*, Fig. 4, and out to the curb on joint *H*. The former is then removed, and sweep *A*, Fig. 6, is placed on spindle *B* with arm *C* and sweep or finger *D* bolted to it and set out the required distance from the center to true up the cheek to the required size. The sweep is then removed and the cheek is carefully felt over. Any soft spots are filled, and it is then slicked and blackened and hoisted off.

In parts of the country where natural gas is cheap it is generally the custom to mix the facing for skin-drying, and then to wet-black the mold. It is then set to one side, covered with sheet iron, and a gas burner is left in it over night. The cost of the gas is nearly offset by the time saved in cleaning, and a better, cleaner wheel is the result.

The core *E*, Fig. 6, which is to form the bottom of the hub, is now dropped down over the spindle and into its seat, which was swept at the beginning of operations. The sweep *A* is now placed on the spindle, and the inside of part *D* is set to sweep the inside of the rim or the outside of the center.

Cores *F*, Fig. 5, which are to form notches and overhang to form the flange of wheel, are set so that the strike will just clear them, so the skin of the core shall not be broken. It will be seen at *B*, Fig. 5, how the cores are cut away where the wheel is to be split.

The split cores *C*, Fig. 5, for the hub are now set, with bolt-hole cores *D* extending thru them. These cores are set in paste in other cores, a channelway being

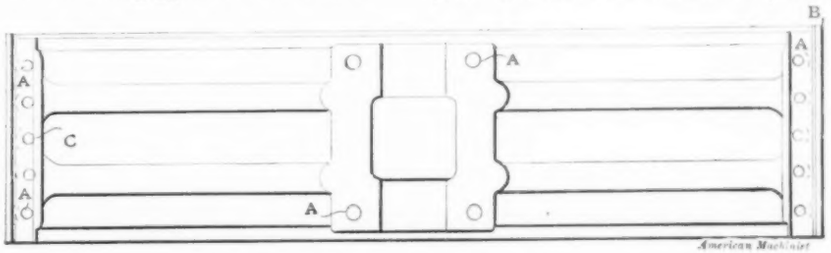


FIG. 2. FACE OF ONE HALF OF WHEEL.

formed in which a cord is laid, which in turn is to form a channelway thru the green sand for the vent to escape from the bolt-hole cores. The lower halves of the lower arm cores are now placed as *H*, Fig. 5; the top halves are then placed as *F*, Fig. 6; then cores *G* and *I*, Fig. 6, and pieces of plank *K* are set on top of them. These are to give the proper distance between the two sets of arm cores.

The lower halves of the upper set of arm cores *J*, Fig. 6, are now placed and the upper halves *S*, but the two coming over *Z*, Fig. 5, are left back from the hub some distance. Bolt-hole cores *L*, Fig. 6, are passed thru the split cores *M*, then the two cores over *Z*, Fig. 5, are pushed into place, receiving the ends of the bolt-hole cores *D*.

Any patching required in the hub is now done, and the sharp edges of the arm cores where they join the rim are filed off, as a neater job can be made in the finishing. The sweep has been moved around as the arm cores have been set to insure accuracy.

Pieces of board are placed under the arm cores and on top as at *O*, Fig. 6, and the cores are clamped together by clamps *N*. The cores forming the lugs or flanges of the rim where it is split and then bolted together, *B*, Fig. 7, are now set on top of flange cores *D*.

The former *X*, Fig. 6, is now placed and weighted with pig iron. Cinders *K*, Fig. 5, are placed around inside the cores. Sand is now rammed in between the arm cores and the former, cinders being used where needed, and the cords from cores *D*, Fig. 5, are held on top of the arm cores; facing sand is used next the former, and the whole is well vented into a pocket or channelway made back of the seat for the upper flange cores which is swept by *P*, Fig. 6.

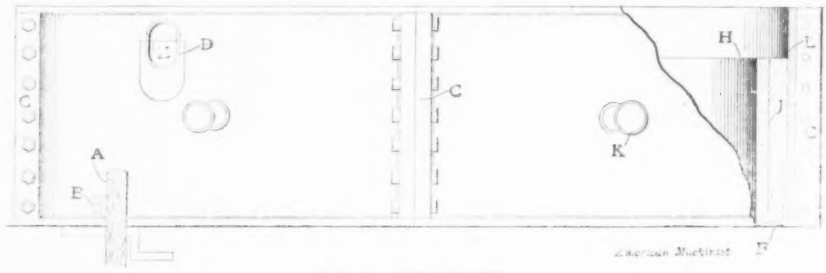


FIG. 4. THE CHEEK.

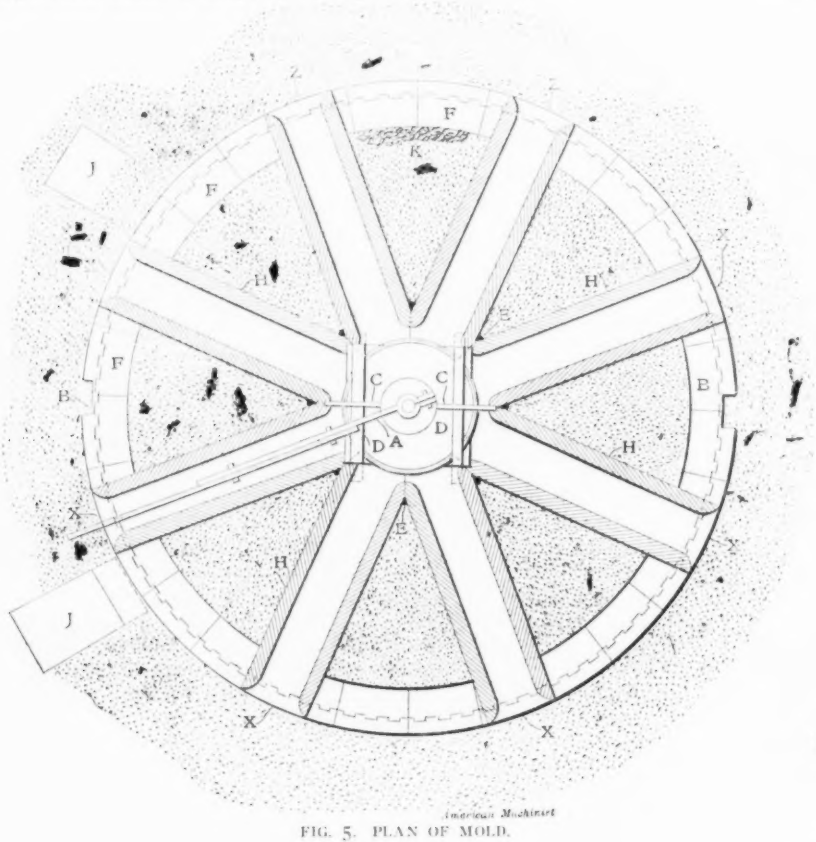


FIG. 5. PLAN OF MOLD.

The center being trued up, the strike is now removed and cores *A*, Fig. 7, are set in the seat swept by *P*, and the face of the mold is finished and blacked.

One employer of mine thought the lead was being terribly wasted when he saw, as he supposed, the parting covered with lead, but when the mold was blacked he saw the molders pick up old newspapers with which the parting had been covered and run the lead into the pot it came from, and he decided they were not quite as wasteful as he had feared. Old papers laid on the floor under a mold blacked overhead will help save expense in lead.

Cores for splitting the rim *E*, Fig. 7, are now set. As there are no prints for these, they are set by measure and the parts of this core for forming the bolt-holes are seen at *F*. The spindle is removed, the hole is filled and center core set. This center core is chambered, and the split cores of the hub come to very near the smallest diameter of the center core, so the chamber of the center core has channelways cut in it for split cores *M*, Fig. 6, to slide up in. The top half of the hub, or the covering core for the hub, is cut in two pieces on a line with split cores *D*, Fig. 8, so that each half may be easily handled, and, being set separately, it is easy to see how each half fits. Thru them are seen holes *B B* for pouring gates and hole *C* for the risers thru which the hub is to be fed.

The cheek Fig. 4 is now tried on, covering cores *E*, Fig. 8, for the rim are fitted around split core *F*, which extends above them, dry flour is placed between the vents in cheek *J* and the face of the cheek, the cores are replaced and the rest of the covering cores are set, some of them having holes for flow-off gates and riser, as *J J*, Fig. 8. The joints of the cores are clayed up, and the holes covered, cinders are placed back of the covering cores and in the channelway, as *H*, Fig. 8, also between covering cores, and curb *I*. Old newspapers are now laid over cores and cinders, sand is covered over the paper, say an inch deep, and plates *K K* are rubbed to a bearing over the covering cores. Cinders are placed around the center, or hub covering, core and run out beyond where anything will interfere with escape of vent, and cords from cores *D*, Fig. 5, are pulled out; the cinders are then covered with paper and sand is rammed up to the top of the core. Clamps *M M*, Fig. 8, are laid across this core, and clamps *N N* across plates over the rim. Gatesticks are set in the hub core and cinders are run from vent of center core to outside and covered with paper. Runner box *O*, Fig. 8, is then placed, resting on clamps *M* and *N* and the curb, some wedges also are used. Timbers *L* are placed, and the runner is built, with flat cores *P* in the bottom of the basin to keep the sand from being cut by the falling iron. Riser *C* is built inside the runner box, and it has a curb of sheet iron around it, being some 5 inches in diameter at the top and 2¾ inches where it joins the casting. Gatesticks are left in, weights *W W* are lowered

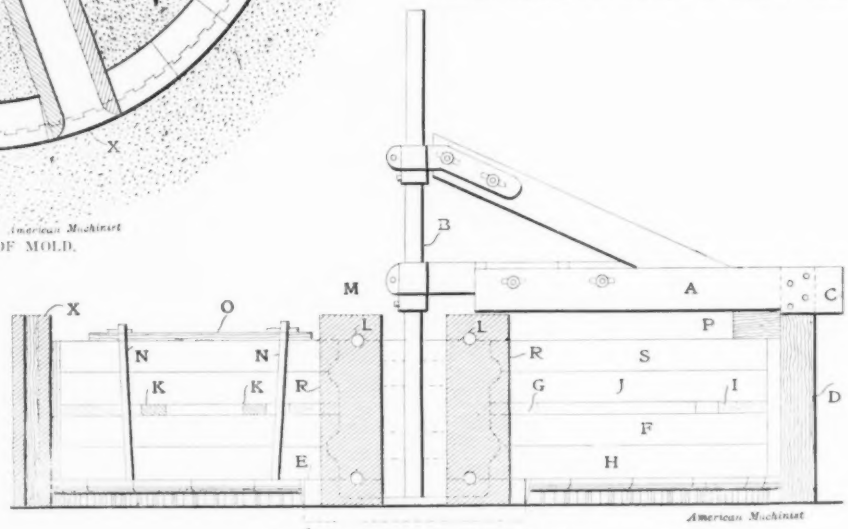


FIG. 6. PLACING THE ARM CORES.

on to timbers L and wedges X are pushed in between runner box and weights, also wedges IX between timbers and box. Pieces of blocking are rubbed to a bearing under timbers L. Blocks of wood R are placed on plates over rim $K\,K$ and pieces of iron, or long clamps are run from under timbers L resting on pieces of blocking $S\,S$ to rim of cheek and held down by clamps T having wedges U between them.

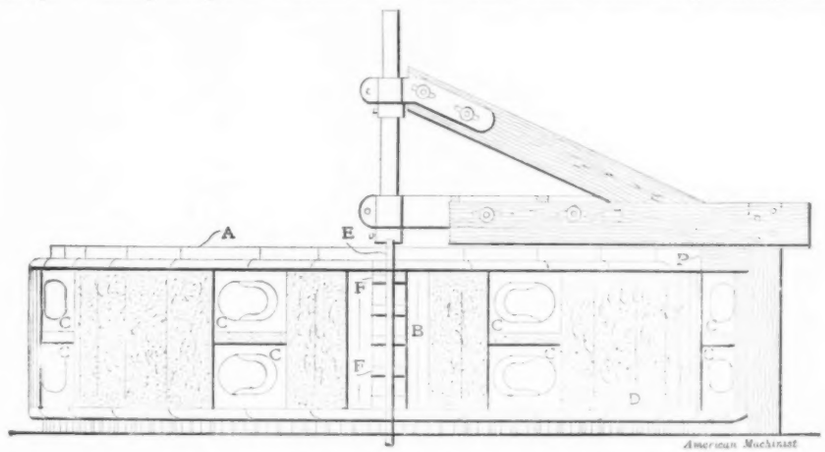


FIG. 7. SHOWING ENDS OF ARM CORES, ALSO COVERING CORES.

The end under timbers L is wedged, then wedges V are pushed in between R and S.

Flow-offs are built from riser J to the side of the flask to holes E, Fig. 4. Part Y of the mold shows holes Z made down thru the extra sand and paper to the cinders for vent to escape. The risers J have balls of clay in them and riser Q has a plate over it and the gatesticks are removed.

When pouring the gatesticks are kept plugged until the runner is half full of iron, when the plugs are pulled by two men with hooks and the iron is let into the mold, thus keeping the first wash of the runner out.

When the casting is cleaned it is marked with a chisel where the split is wanted at $B\,B$, Fig. 1. A wedge is then used on both sides at once and the split easily follows the marked or nicked line.

The plugs used to stop the gate holes in the runner are rather flat iron balls having eyebolts in them extending above the pouring runner. They are blacked and dried and are set over the gate holes just before starting to pour.

The wheel is pumped at 2, Fig. 8, as well as on the hub. The iron settles very quickly in the rim risers, as there is only 5 inches head after the iron has run thru from the runner; hence it is necessary to be ready to feed hot iron very quickly after pouring.

As a proof that new concerns are still coming to the front, we may note that the Brown-Corliss Engine Company, of Corliss, Wis., has secured a contract from the city of Milwaukee for a twenty million gallon, triple expansion, crank and flywheel pumping engine. The prominent builders of the country submitted bids.

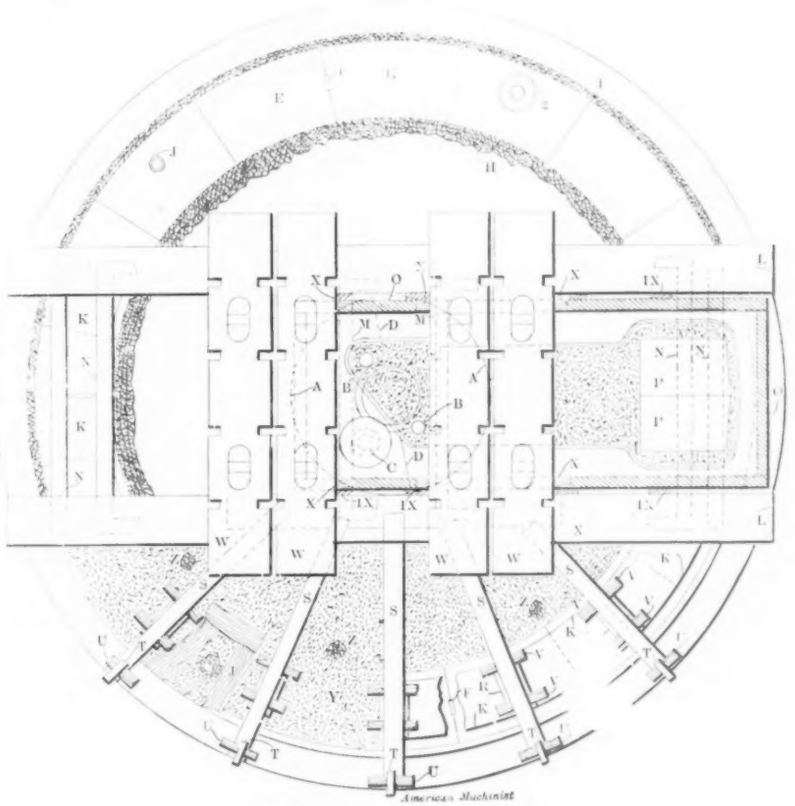


FIG. 8. DETAILS OF MOLD COMPLETE.

Echoes From the Oil Country — Annealing Chilled Gray Iron and High-Speed Steel in a Small Way.

The foundry and the little shop were quite a long way from the new shop. When the old shop was abandoned and the work was moved to the new one, it was decided to still do part of the work at the little shop, as it was busy on a line of work which took heavy castings that had comparatively little to be done on them. By finishing them near to the foundry it saved handling and hauling.

This thing of having shops in different parts of the city has two sides to it, and one of the sides is that, while a telephone will do to talk over, when it comes to transportation some other means have to be devised. In spite of any system that we had been able to devise, it would sometimes happen that all the teams were at the "other" end of the line. It soon counts up, too, if boys are used as a means of transportation over a route about three-quarters of a mile long; and so it will sometimes happen that things have to be done a little differently from the way in which they would be done under other conditions.

"I'm glad you came up just now. I have a piece of steel down at the blacksmith shop getting 'nealed, and I need it the worst kind of a way. Don't you think that we can get up some sort of a scheme to get the blacksmith to do a piece whenever I send it down, and then to send it up without my having to holler for it several times? I believe the teamster forgets to ask for it part of the time, and if I am in an extra big hurry I guess the blacksmith is pretty near sure to forget to put it in."

"Well, my boy, and how would it be if you did your own annealing instead of bothering the blacksmith and the teamsters, and wearing out my clerk and my office boy in answering the 'phone and carrying messages to the blacksmith shop."

"I don't know anything about doing it, but if you will get me some way of heating the steel I am very willing to try to learn."

"Try nothing! It does not take either brains, skill or education to do an ordinary job of annealing, and not very

much muscle, and as for the means of heating the steel, it is already provided."

The young man seemed to think that such a job would be within his capacity, once he got to see it done, but was a bit mystified as to how to get at it.

"If you will keep on the right side of the boss molder you will have no trouble. Get some sand in a place where it will not have to be disturbed. Make a hole in it, say 6 or 8 inches deep, and make the length and width to suit the size of the piece of steel you want to anneal. Have a few handfuls of dry core sand handy. Get some hot iron, a hand-ladleful will do for an ordinary tool, and pour nearly half of it into the hole. It should be at least 1½ inches deep in the hole. Put an inch or so of dry sand on the hot iron, lay the tool on the sand, put some sand on the tool, pour in the rest of your iron, shovel your hole full of sand and put some more on after you have the hole full, just for good luck and good measure; in the morning get your tool. If it isn't soft enough to suit you, dig a deeper hole the next time and use more iron and more sand, and let it lie longer. You can get iron every evening, and you should be smart enough to see ahead as far as that, and, anyway, it will be quicker than trying to get the work to and from the blacksmith shop."

And so it came that this way of annealing was tried and became a regular thing. It even got to be so successful that the young man who did it sent word down to the blacksmith and foremen at the other shops that if they had anything that they wanted annealed "real good," they should send it up; and they soon found that it paid them to do so.

When the high-speed steel first came we did not try to work any of it into tools that had to be machined, but soon we began to hear of the wonderful work that reamers would do, and to have the annealed stock offered to us, and we began to try it.

Some of it worked in a fashion, and some—"Say, I don't know what to do with this blamed stuff. If a tool made from it will last in proportion to the time and patience it takes to make it, it will last forever."

After listening to his talk and seeing the piece he was working on, there was no doubt that it was hard. "'Let's see. Some fellows have been telling something about how they went at it to anneal the stuff. It has to be heated in a box shut up tight from the air, I think, and then heated for quite a long time, and then packed away to cool. Suppose you try it that way once and see how it works." This was in the big shop, and after some trying we got so that we could get a piece annealed so that we could work it after a fashion; that is to say, "we almost always could."

The man in the little shop had been reading the papers, too, and he had been trying to see what he could do at annealing high-speed steel. He began experimenting with short, discarded ends of tools from his tool-holders; and first he tried his regular method, but with poor success. He then tried using sawdust instead of sand and that worked better, but still it was very hard to work. Finally he thought of a method that his father had told him of whereby chilled gray iron could be made very soft, and he tried that, and now he thinks that he *can* anneal high-speed steel.

As this "wrinkle" of softening small castings, or parts of castings that have chilled and are too hard to machine may be new to some, I will tell how it is done.

Several years ago this foundry used to make some light castings that had to be turned nearly all over. The turning extended to one end, which was the lightest part of the casting, and this end would often come chilled to a steel hardness for an inch back. As the pieces could not be machined when they were in that condition, they had to be thrown out. With some grades of iron the number that came so hard was not large, and not much account was made of them, but bye and bye other work got to pressing and the iron that was suitable for it made many of these light castings hard on the end. The body of the castings could be worked well enough, but these ends could not be touched. Even the old plan, that used to help out with those that were not " too awfully hard," of grinding back the points for an eighth of an inch or more, and then grinding off the outside did no good. It seemed as if all the iron at hand would chill if cast into that job, and yet the castings were wanted badly. The boss molder wasn't a chemist, and neither was anyone in the office, and if somebody had been it might not have helped matters any, for miscellaneous scrap is a "miserable sinner" sometimes.

In his trouble the foundryman thought of what he had seen his father do away back in Wales, and he sent one of the boys after some gray-iron chips. Making a depression in some sand, he poured in some iron and, after covering the outside of it with sand, he covered the center with some of the chips. Then he laid a lot of the castings around in a circle with the hard ends in on the chips. Covering the ends with chips he covered the outsides with sand and built it up so that he could pour more iron on to the chips. Then the whole was well covered with sand and allowed to remain until morning.

In the morning it was found that the ends were much the softest parts of the castings, and after that if any of them came hard they were thrown to one side until enough were got together to pay to bother with, and then they were softened, and the process seemed never to fail.

So now in annealing high-speed steel, gray-iron chips take the place of the sand, and the steel comes out so that it works nicely. In fact, it works much easier than any "annealed" that we have bought so far, and, as far as we can see, it does just as good work after being hardened.

Without being able to analyze the iron, I have always thought that the change in the chilled gray iron was a chemical one, and when the first of the soft high-speed steel was shown to me I was much afraid that any action that would make it so easy to work would also be liable to hurt the quality of it, so we took some of the regular tool-holder tools and annealed them and then treated them, and as far as we could judge by their work it did not make them less efficient.

Perhaps someone who reads this can go farther into the matter and find out what is the real nature of the change that takes place. For my own reasoning I cannot see why sand would not be just as good as iron if it were just a matter of holding in the heat. The rate of heating can be controlled somewhat by the amount of sand used, while the time it is desired to keep the piece hot can be regulated by the amount of iron that is used, but while sand gives some annealing action it is not at all like the action of the gray-iron chips.

I will say that this method has not been tried by us on large stock; I think the largest has not been over two inches in diameter.

W. Osborne.

Can any Machinist Match This?

A letter from a certain miller who has for some time been out of employment conveys the information that he had been called across several States to accept a situation. Upon his arrival he discovered that two other millers from far-off places had received similar letters and had been called to compete with him for the position. The employer considered that anyone of the three would suit his purpose and informed them that the cheapest man would be accepted. The three men held a conference and it was decided to permit the first one mentioned to make a lower bid for the place than they, inasmuch as he had traveled the longest distance and did not have a sufficient amount to pay his way back. The bid which he made was comparatively low, but the proprietor took advantage of the poor fellow's unfortunate position and offered him a lower salary, an amount usually offered ordinary laborers. There was nothing for the man to do but to accept it. It was owing to the request which the miller expressed in his letter not to publish the matter, for fear, of course, that it might prove detrimental to him, that *The Operative Miller* refrains from giving the miserable wretch of an employer a lot of free advertising.—*The Operative Miller.*

There are now in use on the railroads of India four different gages: 5 feet 6 inches, 3 feet 3⅜ inches, 2 feet 6 inches, and 2 feet. Two other gages, 4 feet and 3 feet 6 inches, have been abolished. Our standard gage is strangely absent.

A Decimal Time-Measuring Clock.

The illustration, Fig. 1, shows a ten-hour clock which was devised by Mr. Wilfred Lewis, president of the Tabor Manufacturing Company, of Philadelphia, Pa. The duty of this clock is to measure that period of time covering the ten-hour working day, and its object the facilitation of the processes necessary to arrive at the costs of production.

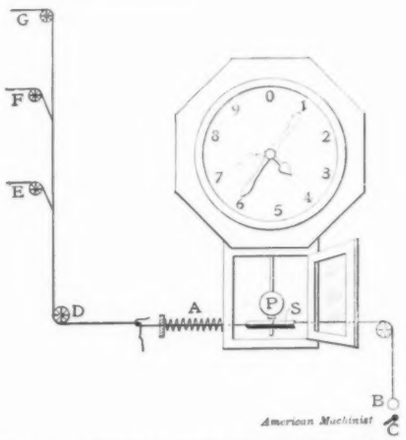


FIG. 1. A DECIMAL TIME-MEASURING CLOCK.

It is an ordinary Ansonia clock with the ratio between the hour and minute hands changed from twelve to ten by substitution of suitable gears made in the shop. The dial was made of paper, in the drawing office, and is glued to the original dial. It reads hours and tenths of hours, no other subdivisions being recognized in this system of time-keeping.

At Fig. 2 is shown a time card. In the upper left-hand corner of this card, opposite to the word "Out," is the number 36. This ought to be 3.6, but the decimal point is unnecessary (the total number of hours recorded by the clock being but 10, 36 hours would obviously be impossible). This signifies that the card was given out for a workman to begin a certain job at 3 hours and 6-10, as shown by the full-line hands on the clock in Fig. 1. Opposite to the word "In" (immediately above the word "Out"), at Fig. 2, will be seen 71; that signifies the time when the job was finished and the card returned to the office—*i. e.*, at 7 hours and 1-10. (See dotted hands on Fig. 1.) By subtracting 3.6 from 7.1 we obtain 3.5, which is elapsed time on the work and is put down under the heading "Man's time." This 3.5 multiplied by the rate per hour gives the wages cost of the job.

At 7 A. M., when the whistle blows, the clock starts with both hands at 0 and runs till 12 o'clock noon. When the men stop for their mid-day meal the clock is stopped, the hour hand standing at 5 and the tenths hand at 0. At 12.42, when the men resume work, the clock is again started, and runs till quitting time, when the clock is again stopped, the hands both standing at 0.

There are four clocks throughout the works similar to the one shown at Fig. 1. The starting and stopping of these clocks is controlled from the one in the drawing office. By referring to Fig. 1 it will be seen that the pendulum *P* oscillates in a slot *S* in a piece of wire. The spring *A* holds this wire piece in such position that the pendulum is free to work. When it is time to stop the clock, the small ring *B* (which is suitably attached to the slotted wire) is pulled down and hooked over the nail *C*. This draws the slotted wires over to the side and stops the pendulums of all the clocks attached to *E*, *F* and *G*, as well as the one shown in Fig. 1. When it is time to start again, the ring *B* is released and the springs on the various clocks draw the slotted wires into position so that the pendulums are free to work

This method of time-keeping is obviously less complicated than the old way. For instance, a job is started at 7.45 A. M. and finished at 1.25 P. M., with 45 minutes meal time; the rate of pay 26½ cents per hour. To find the cost of the work would take considerably more time than it would with the hours and tenths of hours, and the clock working and stopping in unison with the men, so that it at all times shows in hours and tenths of an hour the working time after 7 o'clock.

This seems to us to be a very ingenious application of the decimal system and one calculated to save a great deal of time and labor in computing cost of work. Of course it goes without saying that those who use the clock soon get over the idea that it indicates the time of the day and perceive that it simply indicates elapsed working time for that day, and this, being in decimals of an hour, the readings agree with our monetary and computing systems and reduces the whole thing to the greatest possible simplicity. In Great Britain, with pounds, shillings and pence, the clock will be of little use, but in the shops of the United States, Canada, France, Belgium, Germany, Russia and other countries where decimal systems of coinage are in use, it ought to be of the greatest utility. We venture to predict that our friend Bollinckx, of Brussels, will have these clocks installed in his works within a month after this number of the AMERICAN MACHINIST reaches his place.

IN 71
OUT 36

ORDER NUMBER

DEPARTMENT D M

DAY RATE

IF JOB IS NOT FINISHED SCRATCH OUT THIS F

IF JOB IS FINISHED SCRATCH OUT THIS NF

MFG. NO. OR DESCRIPTION	NO. OF OPERATION	NO. OF PIECES FINISHED	MAN'S TIME	MACHINE TIME	MACHINE NO.
			35		

WORKMAN'S NAME MAN'S NO. D M

I HAVE CHECKED THESE ENTRIES AND BELIEVE THEM TO BE CORRECT.

PAY SHEET	COST SHEET MAN'S	COST SHEET MACHINE

SIGNED BY FOREMAN OR HIS REPRESENTATIVE,

DAY WORK TIME NOTE

DM 1 20M 304 American Machinist

FIG. 2. THE TIME CARD.

What is believed to be a new record in respect to holding up a "heat" was accomplished at the foundry of the Kalamazoo Stove Company last Saturday afternoon. The heat which consisted of 27 tons of metal had partly been poured when the motor gave out. Thirty minutes were spent in a fruitless endeavor to repair it. The motor was then removed and another motor was taken from another department and set up in the foundry. This was installed and connected and the heat finished in perfect shape after a delay of an hour and forty minutes. It is believed that this is the longest time on record that a heat has been held up after such an interruption and then successfully finished.—*Iron Molders' Journal.*

The largest electric light and power plant ever installed on a battleship is on the "Connecticut" recently launched at the Brooklyn Navy Yard. The plant comprises eight Crocker-Wheeler generators direct connected to Forbes engines. The total capacity is 800 kilowatts.

The Development and Use of High Speed Tool Steel—II.*

BY J. M. GLEDHILL.

TEMPERING.

Electricity is also a very efficient and accurate means of tempering such forms of tools as milling, gear, hobbing and other similar cutters, also large hollow taps, hollow reamers, and all other hollow tools made of high-speed steel, where it is required to have the outside or cutting portion hard and the interior soft and tenacious, so as to be in the best condition to resist the great stresses put upon the tool by the resistance of the metal being cut, and which stresses tend to cause disruption of the cutter if the hardening extends too deep.

By means of the apparatus illustrated in Fig. 5 this tempering or softening of the interior can be perfectly and quickly effected, thus bringing the cutter into the best possible condition to perform rapid and heavy work.

Tempering of hollow cutters, etc., is sometimes carried out by the insertion of a heated rod within the cutter and so drawing the temper, but this is not entirely satisfactory or scientific, and is liable to induce cracking by too sudden heat application, and further because of the difficulty of maintaining the necessary heat and temperature required, and afterward gradually lowering the heat until the proper degree of temper has been obtained. In electrical tempering these difficulties are overcome, as the rod is placed inside the cutter quite cold, and the electric current gradually and steadily heats up the rod until the correct temperature is reached, when it can be held at such temperature as long as is necessary, and the current can be gradually reduced until the articles operated on are cold again, and consequently the risk of cracking by too sudden expansion and contraction is reduced very greatly. The apparatus used is very simple, as will be seen by reference to the sketch. It consists of a continuous-current, shunt-wound motor directly coupled to a single-phase alternating-current dynamo of the revolving field type giving 100 amperes at 350 volts, 50 cycles per second, the exciting current being taken from the works supply main.

The power from the alternator is by means of a stepdown transformer, reduced to current at a pressure of 2 volts, the secondary coil of the transformer consisting of a single turn of copper of heavy cross-section, the extremities of which are attached to heavy copper bars carrying the connecting vises holding the mandrel upon which the cutter to be tempered is placed. The secondary induced current, therefore passes thru a single-turn coil, thru the copper bars and vises and mandrel.

Altho the resistance of the complete circuit is very low, still, owing to the comparatively high specific resistance of the iron mandrel, the thermal effect of the current is used up in heating the mandrel which gradually attains the required temperature, slowly imparting its heat to the tool under treatment until the shade of the oxide on the tool satisfies the operator.

The method adopted to regulate the heat of the mandrel is by varying the excitation current of the alternator by means of the rheostat. An extremely fine variation and perfect heat control is easily possible by this arrangement.

RESULTS ACCOMPLISHED.

Having touched upon the development and thermal treatment of high-speed steel, it will now be opportune to refer to its practical use and to some of the most recent work done with it. It is sometimes contended that on the whole not much advantage or economy results from using high-speed steel, but it is easy to prove very greatly to the contrary, and the author proposes to give some figures and facts as to its use and advantage, not only by knowledge gained from results of his own firm, but also from information supplied by many important engineering establishments as to their present workshop practise and for which he is indebted.

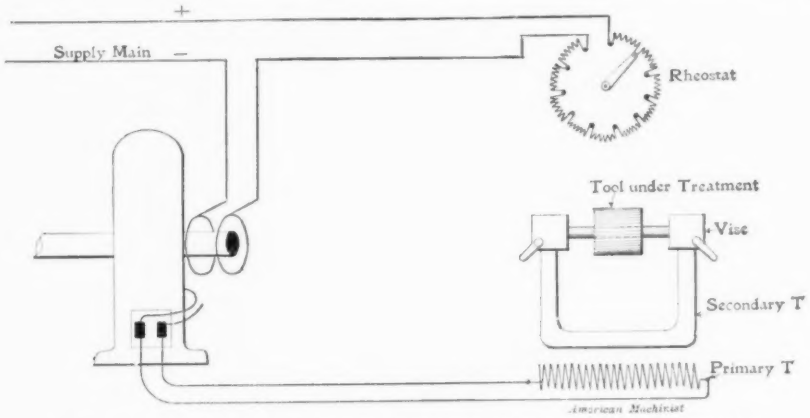


FIG. 5. APPARATUS FOR TEMPERING MILLING CUTTERS, ETC., ELECTRICALLY.

That great economy is effected is beyond all doubt from whichever point of view the question is looked at; for it is not only rapidity of cutting that counts, but the output of machines is correspondingly increased, so that a greater production is obtained from a given installation than was possible when cutting at low speeds with the old tool steel, and the work is naturally produced at a correspondingly lower cost, and of course it follows from this that in laying down new plant and machines the introduction and use of high-speed steel would have considerable influence in reducing expenditure on capital account.

It has also been proved that high-speed cutting is economical from a mechanical standpoint and that a given horse-power will remove a greater quantity of metal at a high speed than at a low speed, for altho more power is naturally required to take off metal at a high than at a low speed (by reason of the increased work done) the increase of that power is by no means in proportion to the large extra amount of work done by the high-speed cutting, for the frictional and other losses do not increase in anything like the same ratio as a high cutting speed is to a low cutting speed. A brief example of this may be given in which the power absorbed in the lathe was accurately measured electrically.

Cutting on hard steel, with 3-16 inch depth of cut, 1-16 inch feed and speed of cutting 17 feet per minute, a power of 5.16 horse-power was absorbed, and increasing the cutting speed to 42 feet per minute, the depth of cut and feed being the same, there was a saving in power of 19 per cent. for the work being done.

Another experiment with depth of cut 3/8 inch and traverse 1-16 inch compared with 1-16 inch traverse and 3-16 inch depth of cut, showed a saving in power of as much as 28 per cent., and still proceeding with a view of increasing the weight of metal removed in a given time the feed was doubled (other conditions being the same) and a still further saving of power resulted. In a word, as in the majority of things, so it is with rapid cutting, the more quickly work can be produced the cheaper the cost of production will be.

Again, as regards economy there is not only a saving effected on the actual machine work, but since the advent of high-speed cutting it is now possible, in many instances, to produce finished articles from plain rolled bars, instead of following the old practise of first making expensive forgings and afterwards finishing them in the machine. By this practise not only is the entire cost of forging abolished, but the machining on the rolled bar can be carried out much quicker and cheaper in suitably arranged machines, quicker even than the machining of a forging can be done.

[Examples of this adduced by the author have already been illustrated by us at page 789.—Ed.]

Another remarkable sample of the gain resulting from the use of high-speed cutting from rolled bars has already been shown at page 752, the articles in this case being securing bolts, made by the author's

*A paper read at the New York meeting of the British Iron and Steel Institute.

firm, for armor plates. Formerly where forgings were first made and then machined with ordinary self-hardening steel, a production of eight bolts per day of ten hours was usual. With the introduction of rapid-cutting steel, forty similar bolts from the rolled bar are now produced in the same time, thus giving an advantage of five to one in favor of quick cutting, and also in addition abolishing the cost of first rough forging the bolt to form; in fact the cost of forging one bolt alone amounted to more than the present cost of producing to required form twelve such bolts by high-speed machining. The cutting speed at which these bolts are turned is 160 feet per minute, the depth of cut and feed being respectively ¾ inch and 1-32 inch, the weight of metal removed from each bolt being 62 pounds, or 2,480 pounds in a day of ten hours, the tool being ground only once during such period of work, and from such an example as this it will be at once apparent what an enormous saving in plant and costs results. On the same principle the sleeves (see appendix) for these bolts are produced from bars, sixty being made in one day of ten hours, this being even a greater saving on the old system than the bolt example shows.,

An illustration of the lathe on which this work is done is also shown in Fig. 6. It is a 12-inch lathe of special design and strength for rapid and heavy cutting, and has a link driving belt of 7½ inches wide, running at a very high velocity and driven by its own motor, so that the power absorbed can always be observed whether the lathe is running idle or cutting.

Equally remarkable results are obtained by operating on stock bars with high-speed milling cutters, and one example, among many, may be cited, which is shown in Fig. 7. Here hexagon nuts for 3⅜ inches diameter bolts are made from rolled bars, the cutting speed of milling being 150 feet per minute, giving a production of ninety nuts per day, against thirty formerly. More than ninety nuts could have been produced had the machine been more powerful.

A further economy of the great saving resulting from the use of high-speed steel was recently supplied to the author by one of the largest manufacturers of textile machinery in Lancashire, and they wrote as follows:

"Our results up to the present time, without being phenomenal, have demonstrated the fact that there are great possibilities for effecting considerable saving by its use, and, as examples, would mention the following:

"In the drilling of gray-iron rails, we have been able to increase the speed from four to eight times, and in one case of milling gray-iron brackets we have, by building a special milling machine and the use of the new material, increased the output six times as compared with that obtained under the old conditions.

"In another case we have been able to obtain 20 per cent. reduction in the piecework price of the turning of some small steel articles, and we have no doubt that there are other instances, especially where we are prepared to build stronger machines, where similar and even greater savings can be effected."

One phase of milling in which cutters made from high-speed steel will play an even more important part than at the present time will be that of gear and similar cutting, it now being possible to make formed backed-off cutters of high-speed steel for all purposes, and the results obtained from the use of them are shown in the appendix, prove beyond all doubt that very great advantage is to be gained from their application and use.

STRENGTH.

Again, rapid cutting with planing tools has also developed extensively, the old cutting speeds of 15 to 25 feet per minute being now replaced by those of 50 to 60 per minute, and in some cases even as high as 80 feet per minute, and for the same reasons, as already described in lathe turning, the power absorbed does not increase in anything like the same proportion to the extra amount of work done, so that the wear and tear on the machine is not materially increased.

It was for some time not thought possible to plane at such high speeds on account of the tools coming into contact suddenly with the job and running risks of snapping off thru shock, but where high-speed steel of proper quality is used this difficulty is overcome, and a good example or two of rapid planing may be quoted. Using a 7-foot planing machine with two tools operating on forged steel of

FIG. 6. ONE DAY'S WORK, ROUGH AND FINISHED, WITH THE LATHE ON WHICH IT WAS DONE.

medium quality, the cutting speed, depth of cut, and feed of each tool is respectively 54 feet, ¼ inch, and ⅛ inch, the speed of reverse being 160 feet per minute.

Another striking example of high-speed planing on a large gray-iron turbine body was: Cutting speed, 36 feet per minute; depth of cut, 1.25 inches, and feed seven cuts per inch, the tool cutting for ten hours without necessitating grinding. Two tools were cutting, each taking a cut as described, the size of the planer being 14 x14x30 feet.

The question of cutting angles for tools is an important one, and the author would advise all interested to peruse the paper written by Professor Nicolson, of Manchester, and read before the Institution of Mechanical Engineers at Chicago this year, and in which he states that the best cutting angle as deduced from the results of experiments is 75 degrees for steel and 80 degrees for gray iron. Of course these angles may with advantage be modified according to circumstances and the nature of any particular class of work.

Objections have been made against high-speed steel on the grounds of its being brittle, but this is not the case where the steel has been properly annealed and the hardening confined to the cutting area, and sufficient support given to the tools when fixed in the machine.

An example of the great pressure-resisting powers of high-speed steel may be given.

When cutting forged steel of about 30 tons per square inch tensile strength and offering a resistance to cutting of about 100 tons per square inch, a tool of 1¼ square inch section was used, taking a cut of ⅞ inch in depth by ¼ inch feed per revolution, equivalent to an area of metal under cut of 0.21875 square inch, the cutting speed being 90 feet per minute, and removing 68¾ pounds of metal per minute, or the huge weight of 4,010 pounds per hour. The tool in this instance was projecting a distance of 1⅛ inches beyond the rest (see Fig. 8), and a calculation shows the stress on the tool to be as high as 78.5 tons per square inch. In another case, cutting forged steel of 35 tons tensile strength and offering a resistance to cutting of 115 tons per square inch, a 1¼-inch square tool being used, the diameter of forging was reduced by 1 inch, equal to ½ inch depth of cut, while the tool advanced ⅜ inch every revolution, the cutting speed being 25 feet per minute and removing 14¼ pounds of metal per minute. With the point of the tool projecting ¾ inch beyond the rest, the tool successfully withstood a stress of 51.6 tons per square inch.

Altho in actual practise tools of much greater section would be used, the results clearly show that, if proper care be taken, tools of high-speed steel are quite capable of withstanding any pressure likely to be met in ordinary workshop practise.

A most important point to observe when taking heavy cuts is that of having the tools quite flat on the bottom side and supported as near as possible up to the extreme edge, as by so doing the pressures tending to break the tool are very considerably reduced. For example, the position of the tool as placed in the rest shown in Fig. 8, would cause a stress of something like 78.5 tons per square inch to be thrown on it, whereas when the overhang is reduced to one-half of the original distance, equal to 9-16 inch, as in Fig. 9, the stress is lowered to 14.27 tons per square inch, a reduction of 80 per cent.

FIG. 7. ONE DAY'S WORK, ROUGH AND FINISHED, WITH THE MILLING MACHINE ON WHICH IT WAS DONE.

HIGH-SPEED TWIST DRILLS.

Perhaps one of the most unlooked-for developments in the use of high-speed steel has been the manufacture from it of twist drills, and it would be safe to say that in no other sphere has the new steel justified itself to a greater extent than in the operations of drilling and boring, as its powers in that respect have revolutionized completely modern workshop practise. It is now possible in many cases to drill holes thru stacks of thin steel plates as quickly and economically as by punching them, thus avoiding the consequent liability to distress the material due to punching action.

The plates of torpedo and other boats, which are comparatively thin and of high tensile strength, can now be drilled in stacks with such facility that it is no longer necessary to punch the holes, while in many articles where it was formerly the practise to core in the holes, as, for example, in cylinder and other covers, or pipe flanges, etc., it is now cheaper and quicker to use high-speed steel and drill the holes out of the solid. Many examples might be adduced in support of these statements, but reference is made to a few striking instances, full particulars of which are given in the appendix.

A short time back the author received a letter from a large firm of structural

engineers in Glasgow giving some remarkable drilling results with high-speed drills, and the following extract may be quoted:

"Drilling mild steel 2½ inches thickness made up of five ⅜-inch plates and one ⅝-inch angle iron, a 15-16 inch diameter twist drill made of high-speed steel, and running at 275 revolutions per minute, with a feed of 75 cuts per inch of penetration, drilled 7,924 holes without requiring regrinding, each hole being drilled in 42 seconds."

As a comparison of the superiority of high-speed over ordinary drills, an instructive result was obtained when drilling forged steel gun-cradles of 5 inches thickness, and which steel is of a very tough nature. An ordinary twist drill was first tried and failed after drilling 8 holes, the end being completely fused, but a high-speed drill afterward drilled 124 holes without suffering any injury whatever. The drills were 2 inches diameter, running at 80 revolutions per minute, and each hole was drilled in six minutes, this being the full power of the machine.

A further illustration of the economy resulting from the use of high-speed twist drills may be gathered from the fact that the author's firm in several instances reduced the cost of drilling per 100 holes by over 60 per cent. without even altering the machines in any way, except by speeding them up.

On gray iron equally good results are obtained. Opening out cored holes in gray-iron girders, from ⅝ inch to 15-16 inch diameter, the high-speed drills do four and a half times as much work as the drills previously used, in addition to lasting considerably longer without grinding, while in another operation where the holes are drilled out of the solid the difference in production is eight times in favor of the high-speed drill.

Equally satisfactory results are obtained from flat drills and other forms of boring tools made of high-speed steel for use in boring large holes out of solid bars, shafts, forgings, etc., the author's firm daily using drills of this type up to 12 inches diameter and boring holes up to 50 feet long.

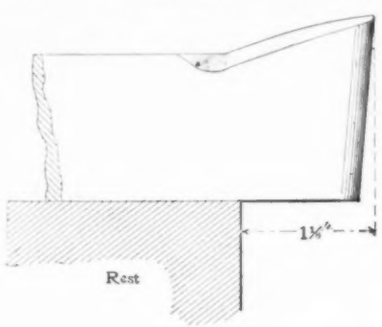


FIG. 8

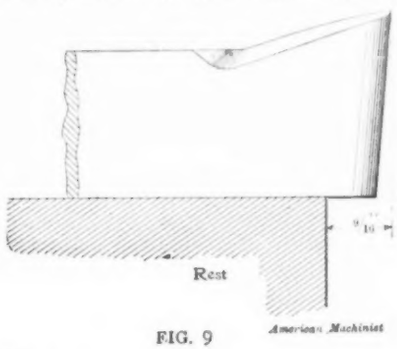


FIG. 9

SETTING TOOLS.

Other miscellaneous uses to which high-speed steel may be applied include taps, screwing dies, reamers, hot punches, circular saws, both solid and with teeth inserted in mild steel bodies, marble drilling, marble planing, rock drills, etc., also in the case of articles whose surfaces are subject to hard wear, such as lathe centers, tube expanding tools, etc.

FINISHING CUTS.

A considerable amount of doubt has been thrown from time to time on the inability to take finishing cuts with high-speed steel, and in the early stages of its development this contention was to a large extent justified, but experience and practise have brought the steel into line and rendered it possible to obtain an excellent finish at high speeds with tools suitably formed and properly arranged in the machines. Some very good examples of finished bright work at high speeds are exhibited on the table and which have been mostly made in semi-automatic machines, high-speed steel being used and *one* cut only taken, and it will be seen on examination that the surface finish is most excellent.

These samples, along with many others placed on the table, also illustrate the finishing powers of high-speed steel when used in machines suitably adapted and they have been turned from the rolled bar with *one* cut only, being guaranteed accurate in diameter to 0.002 inch, while the excellence of surface finish will compare with the best obtainable by the old system of cutting, finishing and polishing.

This finishing quality of high-speed steel is especially advantageous for tools used in automatic and capstan lathes, because it enables the work to be produced so very much more rapidly, and also on account of the great resistance of the steel to wearing action greater accuracy is ensured.

As regards the quality of retaining a sharp edge, high-speed steel makes excellent razors, and will long retain, without sharpening, an extremely keen cutting edge. The author may add that it is thus now possible to those whose time is precious to indulge even in "high-speed shaving."

RE-DESIGN OF MACHINE TOOLS.

The author hopes that the few facts he has given as to the use and development of high-speed steel may indicate some of its uses and progress, but he can scarcely refrain from remarking that many are saying, and rightly so, "Yes! these results are very remarkable; but what of the machines to perform such prodigious work?" and this leads him to speak before concluding as to how one important development often leads up to another of even greater magnitude, and that is in this case the complete revolution in the design of machine tools to cope with the extraordinary increased cutting powers of the latest rapid cutting steels.

It is impossible that the design of machine tools can remain on the old lines since the difference between them and the cutting powers of the steel is so abnormal and a sphere of immense area for the redesigning of machine tools is opened out to the ingenuity of the world's engineers.

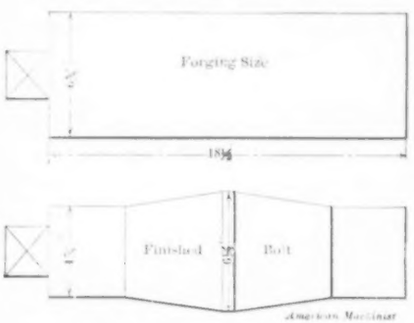


FIG. 10. ARMOR PLATE BOLTS.

That much has been already done is admitted, but the work is naturally of such a nature that only time and experience will accomplish, gradually enabling as nearly as possible the relative powers of the steel and machines to be equated.

In the machine tool department of the author's firm, this branch of the subject of remodelling their tools has received the closest attention, and a type of their modern 18-inch center lathe for high-speed cutting may be mentioned. It is capable of exerting 65 horse-power, equivalent to a belt width of 12 inches, and with the aid of a variable speed motor a range of cutting speeds from 16 to 400 feet per minute is possible, this comparing with an old type 18-inch lathe having a belt of 4-inch width, and capable of exerting only about 12 horse-power.

In a similar way the old types of planing, milling, drilling machines, etc., are all more or less obsolete, and new designs are already constructed to cope with work at speeds and feeds described in this paper.

It is indeed a pleasure to see the new type of machine tool operating with high-speed steel, and treating the work it has to turn out in such a business-like way, throwing off shavings from steel and iron as one usually sees in turning wood, and imparting a life and energy to the whole establishment in remarkable contrast to the sleepy rate at which metals used to be turned and machined for so many years past, thus exerting an influence on everybody therein to get "a hustle" on that is positively exhilarating in its effects.

The chemists and metallurgists with the skill they have brought to bear in assimilating the metals provided by nature to

make so wonderful a product as this high-speed steel, have set a formidable task to the mechanical world, but it is satisfactory to observe that in most quarters, engineers, altho for the time being in a secondary position, are roused to exercising their fullest energies in getting level. This competition can only be considered as a healthy sign, since it will give further impetus to the steel maker, and remind him to continue to fathom more and more the mysteries and powers of this steel.

In concluding this paper the author would add it cannot be denied that the question of high-speed steel is one of vast importance to all manufacturing countries, for if they are to hold their position in the world's competition they will be compelled to study the use and advantages to be derived from its adoption, and, in addition, to bring up their machinery into the most modern and efficient form for obtaining the utmost producing capacities.

The powers of the cutting steel and the machine should be as nearly reciprocal as possible, for, given those conditions, manufacturers place themselves in the most favorable position for the rapid and economical turnout of their products, and for best meeting their rivals in the open field of competition; and lastly, notwithstanding the wonderful results obtained with the new cutting steel, and developed comparatively so rapidly, nothing approaching finality must be admitted by the steel maker, but incessant diligence, experiment and research to discover still more the best combinations of nature's metals, should be his constant aim, and in the doing of which not only is there much pleasure derivable to himself, but in addition there is the benefit it is possible to render to the whole world.

An accident recently occurred to a 1,000 horse-power steam engine which had been running twenty-two years in a mill at New Bedford, Mass. On Friday, November 7, the builders in Providence were directed to make the repairs at once. An inspection, as narrated in the *Board of Trade Journal*, showed that the engine would require a new back cylinder head, piston head, piston follower, packing ring and junk ring; piston rod 4⅝ inches in diameter and 9 feet in length, also a new crosshead. The weight of these parts was about 2½ tons, and the forged connecting rod, which was 20 feet in length, weighed 2,500 pounds. It was necessary to make a casting of the back cylinder head, which was done, and the casting delivered to the engine company in one day, and after 45 hours of continuous labor the various parts of the engine were packed in a special express car and shipped to New Bedford attached to a regular passenger train. On arrival at New Bedford the parts were assembled, and at 7 o'clock on Monday morning, November 10, the engine was started, indicating 1,200 horse-power, and has been in operation ever since.

Planing Cycloidal Curves.

BY HOWARD A. COOMBS.

At various times heretofore I have described for the readers of the AMERICAN MACHINIST a number of planers possessing some interesting or unusual characteristics, and last year I wrote up the art of

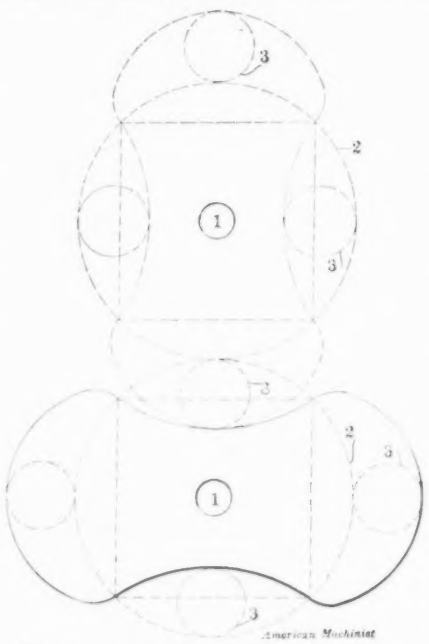


FIG. 1. EPICYCLOIDAL PUMP PISTONS OR REVOLVERS.

gear generating, in which the theory of cycloidal and involute tooth curves was briefly discussed and machines for generating the said curves were described.

I have had the purpose in mind for some time to describe some machines for planing the cycloidal surfaces of the "revolvers" of blowers, rotary pumps and the like, which partake of some of the characteristics of both planers and gear cutters, and to do so is the purpose of this article.

The revolvers, which run in opposite directions in mesh with each other, as indicated in Fig. 1, are really gears having a small number of teeth, each tooth being the complete epicycloidal curve described on the pitch circle 2 by the rolling or describing circle 3. In ordinary epicycloidal gear teeth only the initial portion of the curve is used, and that to form one side of a tooth; the other side being formed by a similar epicycloid, the describing point of which starts from a point on the pitch circle distant the width of the tooth from the former starting point, and the top of the tooth which would be so formed is truncated.

Where the revolvers have two lobes each, as shown in Fig. 1, the diameter of the rolling circle is taken equal to one-fourth the diameter of the pitch circle, and if the revolver were to have three lobes, the rolling circle diameter would be one-sixth the pitch circle diameter.

The conjugate hypocycloid to the epicycloid so formed, is described by a point on the same rolling circle when the latter is rolled on the inside of the pitch circle.

The problem presented is, therefore, to cause the tool to travel relatively to the work in the path which a point of the rolling circle would describe when said circle was rolled first on the outside of the pitch circle to form the teeth or lobes, and then on the inside of the pitch circle to form the spaces, the cut to be made for the full length of the revolver.

The mechanism invented by Mr. J. I. Wilkin, of Indiana, for this purpose, is shown in the accompanying illustrations, taken from his patent, granted May 23, 1893.

Referring first to Fig. 2, the revolver *R* is mounted on a shaft 27, supported in two standards 7, 7, and carrying at its outer end a worm-wheel 51, rotatable by worm 53 and hand-wheel 54. Secured by intermediate sleeves to this shaft, outside the standards 7, 7, are the internal gears

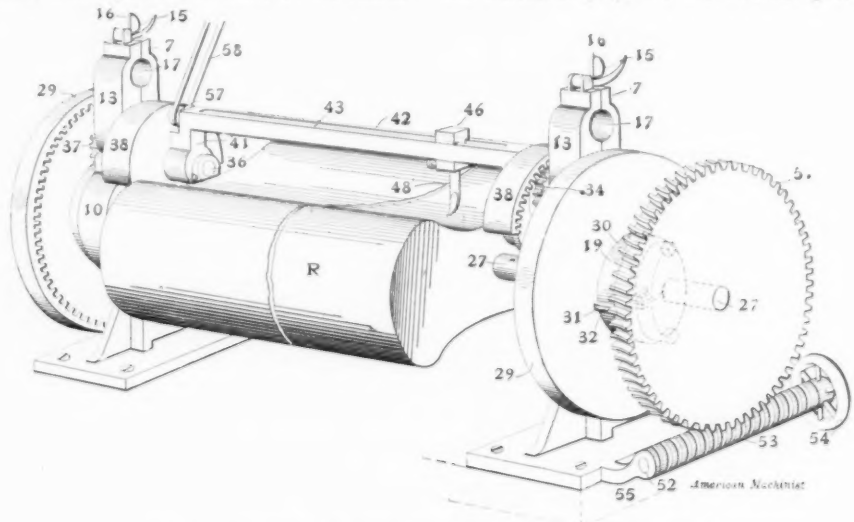


FIG. 2. WILKIN'S PLANER FOR CYCLOIDAL REVOLVERS—1893.

29, 29, one of which is shown in section in Fig. 3. These are used when the spaces or hypocycloidal portions of the revolver are being planed. Each of these internal gears drives a pinion 37, Fig. 3, keyed to a stud-shaft 35, journalled in each of the

standards. The pitch diameter of the internal gears is the same as that of the revolver, and that of the pinions 37 equals the pitch diameter of the rolling circle 3.

The inner end of each stud-shaft 35 carries a crank 36, having a crank-pin 30, the center distance between said crank-pin and stud-shaft being equal to the radius of the pitch circle of pinion 37. Loosely mounted on the crank-pin is a sleeve 39, the flange of which is formed into an internal segmental gear 38, the pitch diameter of which is one-half that of the large internal gear 28 and consequently twice that of pinion 37. The teeth of this segmental gear engage a fixed, non-rotary pinion 34, equal in diameter to pinion 37 and secured in axial alinement therewith. The object of these segmental gears and stationary pinions is to keep the tool normal to the surface upon which it is operating, as will more clearly appear hereinafter.

Clamped to each sleeve 39, by bolt 44, is the end 41 of the cross-rail 42; along which the tool-holder 46 is reciprocated by screw 56, driven by pulley 57 and belt 58 from any suitable, reversible countershaft.

After the tool 48, the point of which lies in the line of centers of the opposing crank-pins 30, has taken a cut throughout the length of the revolver, and has returned, the hand-wheel 54 is given a turn, which has the effect of not only rotating the revolver to present it for the next cut, but also of swinging the tool thru an arc forming a portion of the perifery of the rolling circle 3. The relative movement of tool and work thus obtained is the same, as I have shown in my article on gear generating above referred to, as would be obtained by rolling the circle 3 thru the same arc, inside the pitch circle of the revolver. Now, if it were not for the segmental gears 38 and the stationary pinions 34, the tool-bar 42 could freely swing around the crank-pins 30 as centers. The engagement of said gears and pinions, however, holds said bar in place and by the described movement of the crankpins thru the arc of feed the tool is kept pointing toward the center of the pitch circle of the revolver.

To plane the epicycloidal surfaces, external gears 28, of the same pitch diameter, are substituted for the internal gears

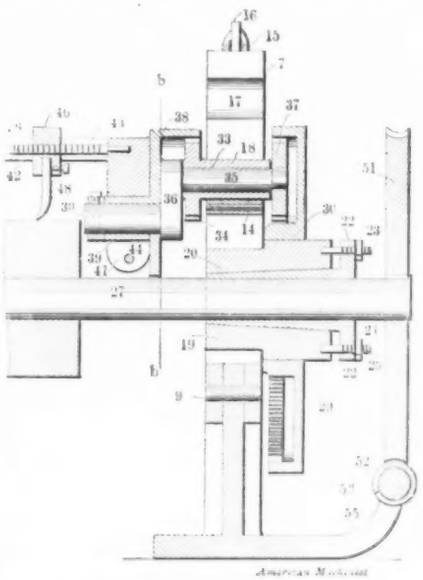


FIG. 3. SECTION OF DRIVING MECHANISM OF WILKIN'S PLANER.

29 and the axes of the stud-shafts 35 and stationary pinions 34 are moved outwardly so that pinions 37 mesh with the said external gears. The segmental gears 38 then mesh with the lower sides of pinions 34 instead of with the upper sides.

An improvement upon this machine was patented on the same date by Mr. Wilkin, but as the principle and general arrangement are similiar to the preceding, I will not stop to describe it here, but will proceed to a brief description of an attachment for ordinary planers, patented in 1895 by W. W. Wainright and J. H. Morrison, of Indiana, by means of which cycloidal curves can be planed.

In Fig. 4, 1 represents the cross-rail of a planer, 2 the carriage, which is disconnected from the feed-screw when the attachment is in use, and 3 the tool-holder, which is free to move vertically on the carriage 2. To the upper side of the rail 1 is secured the gear segment 6, which represents the pitch circle on which the epicycloidal curve is to be described.

Pivoted at 7 at the center of the circle is an arm 8, the outer end of which is toothed and engages a worm on the shaft 9, whereby the arm 8 can be swung on its pivot. A bearing 10 is formed in said arm, in which is mounted the shaft of a pinion 11, meshing with the segment 6 and representing the describing or rolling circle of the epicycloid.

In order to give to the cutting point of the tool 4 the same motion as that of a point on the perifery of this rolling circle, *i. e.*, the pitch circle of the pinion 11, so that the tool will plane the epicycloidal surface 5, the shaft 10 of the pinion carries the crank 12, equal to the radius of its pitch circle, the pin 14 of which engages the arm 13, rigidly attached to the tool-slide 3. Thus by rolling the pinion on the segment, by means of the worm-shaft 9, the center of the pin 14 describes an epicycloid to the pitch circle of the segment 6, and the point of the tool 4 partakes of precisely the same movement, owing to the rigid connection 13, the carriage 2 sliding horizontally and the slide 3 vertically, as required.

To keep the tool normal to the cut the segment 15 is provided, on which the tool-holder 16 can be moved by worm 17. For the right-hand side of the curve, the segment 18, shown in dotted lines, is used. To plane the conjugate hypocycloid 22, the arrangement shown in Fig. 5 is used. The pinion 11 is located within the pitch-circle represented by segment 6, but instead of using an internal segment, a sec-

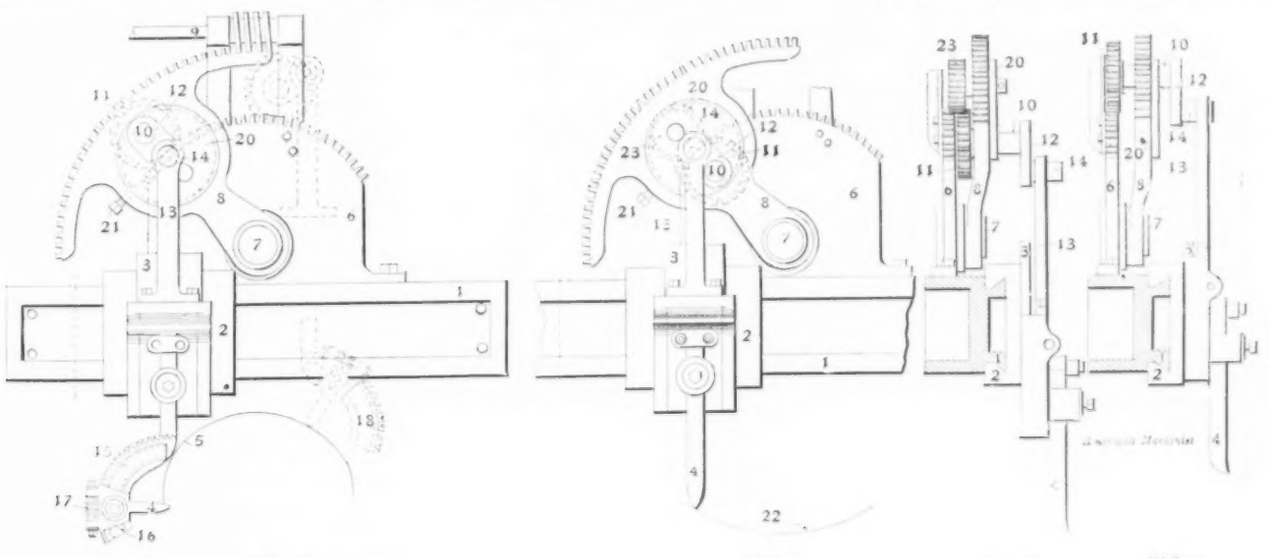


FIG. 4 FIG. 5 FIG. 6 FIG. 7

WAINWRIGHT AND MORRISON'S ATTACHMENT FOR PLANING CYCLOIDAL CURVES—1895.

ond pinion 23, meshing with said segment 6 and with the pinion 11 is employed. The arrangement is otherwise the same.

To adapt the attachment for both uses, the shaft 10 of the pinion 11 is mounted in a disk 20 carried by the arm 8. This disk can be turned to position the pinion inside or outside the pitch circle of the segment 6, and is then secured by the set-screw 21.

Figs. 6 and 7 are end views of the arrangements for planing the hypocycloid and epicycloid respectively.

This simple arrangement enables an ordinary planer to be adapted for planing these curves, which are ordinarily considered to require a special machine.

Quick-Change Gear for Lathe.

The half-tone, Fig. 1, illustrates the 16-inch lathe built by the Bradford Machine Tool Company, of Cincinnati, Ohio, and equipped with their new gear box, the construction of which is brought out clearly in the line engravings. The method of attaching and of connecting from the spindle will be understood from the photograph and from the elevation in Fig. 2; the latter shows also the clutches for connecting or disconnecting either feed rod or screw, and the stop rod for automatically releasing the feed.

Referring to the sections given in Fig. 2, it will be seen that the gear box contains

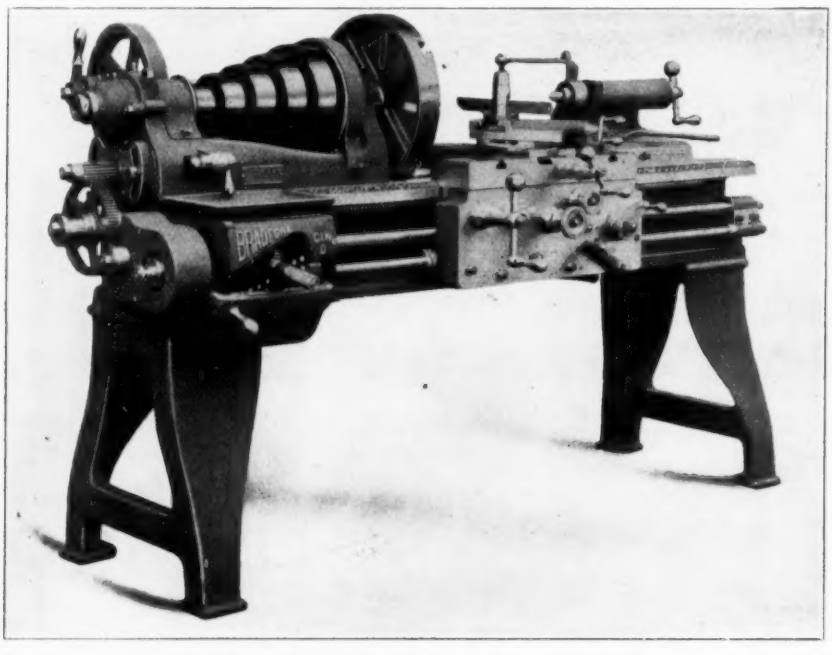


FIG. 1. 16-INCH LATHE WITH NEW FEED GEAR.

at *A* a cone of eight gears carried on a shaft for driving the feed rod and screw, and a sliding gear *B* which acts as a driver for the cone and may be dropped into mesh with anyone of the eight gears forming that member. The shaft driving gear *B* carries loosely at the outer end three gears *C*, any one of which may be connected by a sliding key to the shaft. The three gears are rotated by gears mounted freely at *D*, the intermediate *E* carried on a long stud on quadrant *F* being engaged with one of the three in the set *D*. Now, leaving the gears in the positions shown, it is obvious that by operating the plunger controlling the key in gears *C*, twenty-four rates of feed may be obtained, or eight for each gear in set *C*. Then, by the three positions for intermediate *E*, the number of feed changes is increased to seventy-two.

At *G* will be noted a support for the driving gear which is formed solidly on its shaft. The bracket *G* is bolted to the quadrant and has the under part cut out to allow the intermediate gear to mesh in the pinion, and as the bracket turns with the quadrant it supports the pinion no matter which one of the three gears the intermediate may be in mesh with.

Fig. 3 shows the quick-change gear cut out entirely, and ordinary change gears

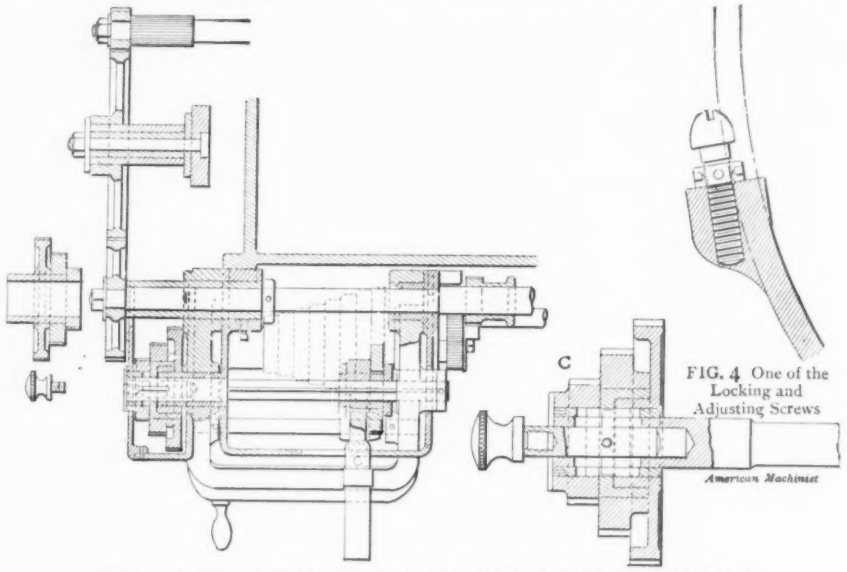


FIG. 4 One of the Locking and Adjusting Screws

FIG. 3. SHOWING LEAD SCREW DRIVEN THRU REGULAR CHANGE GEARS.

used. It shows also to an enlarged scale the plunger and sliding key whereby one of the three gears *C* may be keyed to the shaft, allowing the other two to rotate loosely. The nurled knob can be taken off, allowing a gear of any required size to be put on the lead screw. The three gears are fitted with tool steel bushings, hardened and ground. The center gear has a keyway cut thru and each of the outside gears a keyway cut on one side only, allowing the nurled knob and plunger to be pulled in, out, or to central position. A spring pin holds the plunger when set.

The locking device for the handle which controls the position of gear *B* is shown at *H*, Fig. 2, and consists of a shoe with a semicircular recess at the end which snaps under the heads of the locking screws, each screw head being of a conical form, as in the enlarged detail Fig. 4, to fill a cavity in the under side of the controlling handle. The screws can be raised and lowered to allow the gear in the frame to mesh correctly with the gears of the case, thereby enabling the operator to use gears other than those ordinarily used, simply by adjusting the screws until the gears mesh properly. The relative positions of the eight screws will be seen from the half-tone and the front view in Fig. 2.

The threads cut with this gear range from 3 to 46 per inch, the screw cutting feeds being 4½ times the feeds for turning. The 16-inch lathe illustrated is back geared 9.25 to 1, has power cross and longitudinal feeds, a gibbed carriage, and a ground spindle running in adjustable taper, bronze boxes. The swing over the carriage is 10⅜ inches; the hole thru spindle 1⅛ inches. The cone pulley takes a 2½-inch belt, and the machine weighs 2,000 pounds.

In the "Caronia," the latest and largest of the Cunard liners, it is estimated that 1,800,000 rivets were used, the total weight of which was about 600 tons.

Tax-Free Alcohol for Industrial Purposes.*

BY M. C. KRARUP.

Before attempting to show what forces are at work which will eventually compel the adoption of alcohol as a fuel for all motors, taking the place of gasoline, kerosene, benzine, and to some extent of coal, and which will finally force the American motor industry to produce alcohol motors, if at first only in protection of its export markets, and which will exert a strong pressure for the removal of the internal revenue tax which at present stands in the way of the employment of grain alcohol for any industrial purpose in this country, a summary of previous articles in the AMERICAN MACHINIST relating to the technical status of alcohol as a motor fuel, as so far developed, will be in order for the purpose of facilitating a general survey of the whole question.

Setting aside all possibly illusory accuracy in figures, it may be said that:

(1) The stationary alcohol motor has been proved superior in dynamic efficiency and thereby the equal in economy to the motor burning petroleum products or benzol, provided the price of alcohol is about equal, volume for volume, to that of gasoline (and somewhat higher than that of kerosene or benzol), and provided the work represents an approximately constant load, rendering possible an approximately constant compression and motor temperature. The present necessity of starting the alcohol motor with gasoline, or after preliminary heating, constitutes no serious objection in stationary work. The alcohol, whether pure, hydrated or "denatured," may without practical difficulties be fully vaporized before its introduction in the cylinder, if the speed of the motor does not exceed 250 to 300 revolutions per minute and the stroke is about 1⅘ times greater than the diameter. But, so long as the compression remains high (90 to 140 pounds per square inch) equally good results are obtained by spray injection and a short stroke is no more uneconomical than with gasoline.

(2) For portable motors, as used in agriculture and mining, the same holds true in a measure, as the conditions are similar, with a considerable margin of advantage for alcohol added from the facts that it may be a local product and that the danger of fire and explosions from incompetent handling is much reduced.

(3) For marine use the safety of alcohol is immensely emphasized in comparison with gasoline, while it is superior to kerosene in freedom from various combustion troubles under variable loads. Here the starting with gasoline is objectionable, however, and the much reduced efficiency under reduced loads (while characteristic of all explosion engines, with any other fuel, in only slightly lesser degree) still remains to be overcome, in part, by the perfecting of a throttling system adapted for the fuel, a better graduation

*A continuation of "Alcohol for Motors," at pp. 1363, 1401, 1428 and 1494.

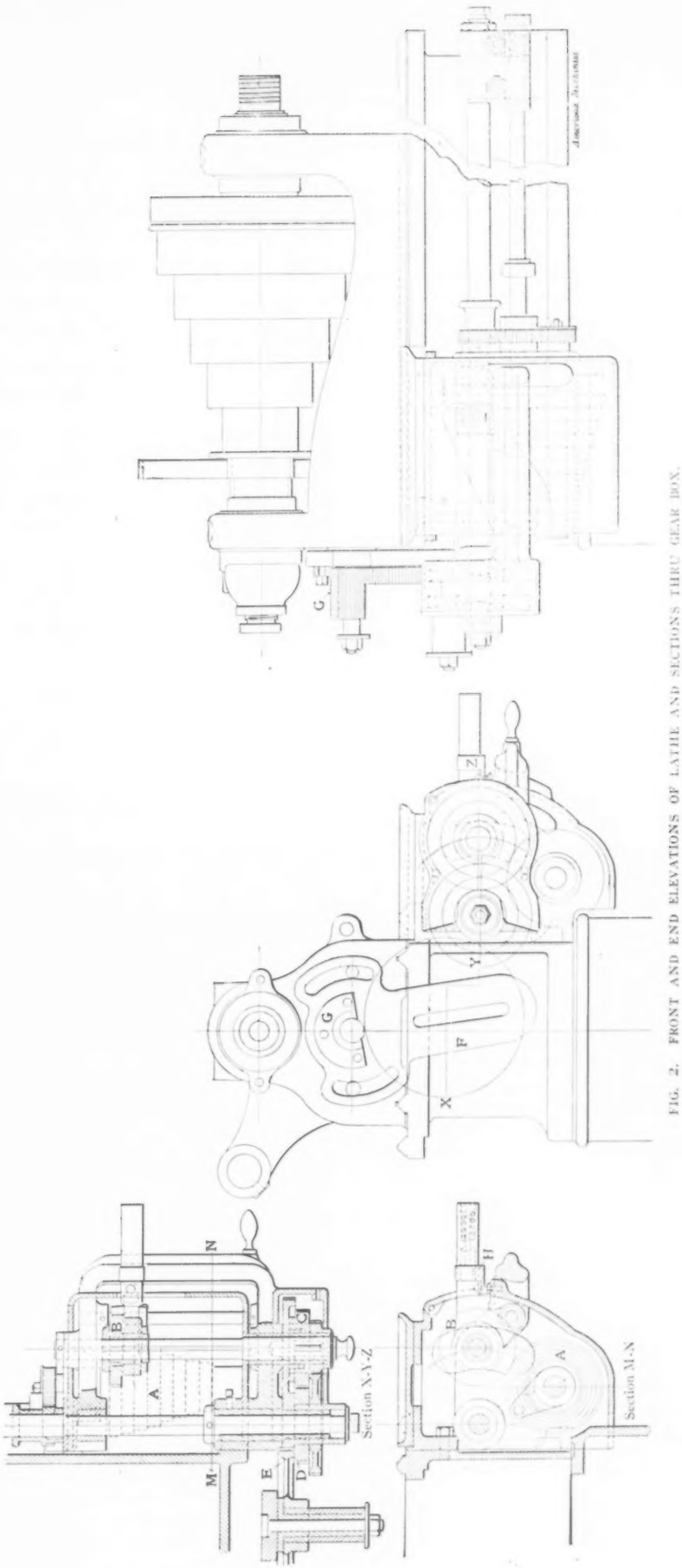


FIG. 2. FRONT AND END ELEVATIONS OF LATHE AND SECTIONS THRU GEAR BOX.

of the artificial cooling and by other means. Spray injection and approximately constant compression under varying power development are strongly indicated as desirable features yet to be perfected, but which when perfected will probably carry with them the practicability of starting the motor, from cold, with alcohol. The promising property of alcohol in these respects is its combustibility under widely varying proportions of air admixture, which should render it possible to have a wide throttling range with small variation of compression.

(4) For automobile work all the disadvantages of alcohol for marine work are accentuated, but with the same promise of relief—a relief obtained at present only by blending the alcohol with gasoline or benzol, which is an expedient liable to delay the true solution by obscuring those peculiarities of alcohol on which the proper throttling system must be based, besides being impracticable in requiring a specialized fuel not everywhere procurable. For the perfected alcohol automobile motor, capable of being started with alcohol alone from cold and of being operated reliably very much below its full power capacity for any length of time, the changes from present automobile practise which are indicated must be the same as mentioned for marine alcohol motors, with a strong probability that multiple-cylinder motors alone should be used, so that the range of power variation may be increased by cutting out one or more cylinders, leaving the others working with better mixtures. The water contained in the alcohol and the high compression both tending to produce a "cool cycle," or diminished waste of heat, the possibility of dispensing with water cooling is in the foreground and gains strength if only multiple-cylinder motors are used (giving smaller cylinder dimensions and proportionately higher heat radiation for a given power).

Farther in the background stands the possibility of perfecting variable stroke as a means of power control which would permit constant compression in about the same measure as the most perfected gasoline carburetters at present, especially in conjunction with gear-driven inlet valves, permit constant composition of the fuel mixture. Pending such possible developments, there should perhaps be a return to "throttling on the exhaust" as one of the most ready means for regulating the compression without varying the composition too much, on the theory that burnt gases retained in a cylinder (preferably of somewhat lengthened stroke) have a tendency to remain stratified so as not to mix with the incoming charge. Finally it should probably be kept in mind that the two-cycle principle seems much better adapted for alcohol which requries constant and high compression than for gasoline which requires constant composition. Premature ignition would not easily take place, the expulsion of part of each new charge with the exhaust, at high motor speed, would result only in power reduction without other complications; and these phenomena constitute the two principal objections to two-cycle design for gasoline motors.

With all due emphasis on the drawbacks which still exist to the employment of alcohol for automobile motors, it is evident that each of them has its counterpart in the gasoline motor and that the already established excellence of the alcohol motor for stationary power opens a large field of immediate usefulness, from which, as a basis, the adaptation to variable loads and variable speeds may be rationally and progressively accomplished along the lines of modified design indicated in the foregoing.

THE EFFECT OF THE PRESENT TAX.

Under conditions of free industrial development, unhampered by special tax and the requirement of a denaturing process, it is evident that the showing already made for alcohol as a motor fuel would be sufficient to secure steady expansion and progress in its application in competition with gasoline, but unfortunately these ideal conditions exist nowhere, and nowhere less than in the United States. Here a tax of $2.08 per gallon not only directly prohibits the use of ethyl alcohol for all purposes except those which make for vice, crime, poverty and corruption, but indirectly the same tax compels thousands of mechanics to do their work in the poisonous fumes of low-grade wood alcohol and removes all incentive to the improvement of petroleum products. The latter factor means a great deal in the way of retarding progress in engine design, because alcohol must compete with the possibilities of kerosene as much as with the gasoline and benzol actually in the market. While it may be impossible, as claimed, to produce gasoline in larger quantity than 2 per cent. of the kerosene production—quite insufficient for the growing demand—it is more than a guess that active competition with alcohol would quickly demonstrate that there may be produced in large quantities new grades of kerosene which could be employed as motor fuel without those difficulties from "splitting" of the components, with attending soot, smoke and odor, which have so far stood in the way of utilizing kerosene instead of gasoline, and which are at least in part responsible for the low thermic efficiency of kerosene motors. While such new kerosenes, probably mostly hexanes, would not have all the advantages of alcohol, being not miscible with water and containing no oxygen to be liberated to help the combustion, it is difficult to say at present how the economical competition between them and alcohol would figure out. Thus the tax on alcohol not only prevents its use, but even surrounds with uncertainty the question of its economy after the tax shall eventually have been removed. For the removal of this uncertainty a series of experiments with special kerosenes as motor fuel would seem to be advisable.

Moreover, the tax, deeply intrenched in the fiscal system of government and barricaded behind pseudo-moral notions as to the government's patriarchal duty to rob as well as to poison potatorial citizens (by raising the price and fostering adulteration of their libations), makes it appear to many "practical" reformers that it would be a great step in advance if the United States would only remove the tax from the ethyl alcohol, used for about one-half of the industrial purposes for which it is indispensable, while following the example of Germany and France in saddling itself with the endless and thankless trouble of spoiling it all more or less by a large variety of denaturing processes—a different one for each industrial purpose, almost—and a huge administrative detective organization for trapping the violators of the system.

This half-way position is the one adopted by the author of the Boutell Bill introduced in the Fifty-eighth Congress and by the Committee of Manufacturers "formed to assist in securing cheaper alcohol for industrial purposes," whose headquarters in New York is the center of the alcohol movement in this country, but whose efforts are unfortunately devoted to explaining the intricacies of the connection between the fiscal interests of the government and the expansion of national wealth which would follow "tax-free denaturized alcohol" and a reduction of the tax on potable alcohol from $1.10 per proof gallon to 70 cents per proof gallon, many and excellent arguments being adduced to prove that the latter figure produces the highest revenue.

Altho it is known that the consumption of ethyl alcohol in the industries and arts has decreased in this country to less than half of what it was twenty years ago, amounting now to no more than 5 million proof gallons (or about 2½ million gallons pure alcohol), while manufacture in general has doubled and the population has increased 50 per cent., and altho, on the other hand, Germany with one-half less population in 1902 consumed 58,632,840 proof gallons of denaturized alcohol and about 55,500,000 proof gallons of low-taxed pure alcohol, all for industrial purposes representing a profitable and varied production of many times the value of the alcohol, and from competing in which the United States is excluding herself, and tho it is well understood that our high tax causes 80 to 90 per cent. of all whiskey sold at retail in this country to be adulterated and wood alcohol to be substituted, and tho 16,416 illicit whiskey stills have been seized by Internal Revenue officers in the nine years 1894 to 1903, since our tax-rate was raised from 90 cents to $1.10 per proof gallon, showing the effect of the tax toward corruption and defeat of the ends of both justice and temperance and health; and altho, finally, the denaturizing processes employed in Europe, besides being costly and inapplicable to more than

about one-half of the industrial uses of alcohol, are recognized as involving technical losses and troubles wherever employed and intolerable complications in government surveillance—in spite of all this the idea of placing the United States in the van of the rest of the world and in a position to build up new industries and offering new home markets for the products of agriculture in a manner increasing the national wealth by many hundreds of millions of dollars annually, while also protecting the health of her citizens, by the simple expedient of entirely abolishing all tax and restriction on the production of grain alcohol, has at present no active advocates—mainly because it is believed to be impossible to induce Congress to consider any such measure in the face of the resistance which would be expected from the wood-alcohol interests and the petroleum interests, in addition to the trouble of devising means for raising 130 million dollars of revenue from some other source than the distillation of alcohol.

While there is no space in the AMERICAN MACHINIST for dwelling upon this phase of the subject, it seems impossible to withhold the remark that the proper forum for a free-alcohol agitation, under these circumstances, must be with the people at large, who may decide that the questions involved are more fundamental and more important than any questions of the source of government revenue. If a national revenue of $130,000,000 (minus the enormous cost of collecting it) is obtained at a loss of, say, $1,000,000,000 in national wealth production under the present system, the question of its abolition should be made a political issue, with a place in one or another of the political platforms, rather than a subject for congressional tinkering.

Those interested in motors and automobiles have special reason to hope that the Committee of Manufacturers will turn its agitation in this direction toward a clear-cut, permanent solution of the problem, because it has already been demonstrated in Europe that denatured alcohol, constituting a *special* fuel not everywhere obtainable, subject to onerous regulations, and changing in composition at every political boundary line, will not for a long time yet recommend itself for use in any motor not absolutely stationary and located in an industrial center where the demand for such special fuel may be sufficient to command commercial attention.

In the American alcohol movement it seems to be contemplated, also, to employ methyl alcohol as a denaturant, altho in its cheapest crude grade it is technically the most doubtful substance that could be employed.

The adoption of the European plan of denaturing would therefore, so far as motors are concerned, surely result in limiting the use of alcohol to stationary motors and the incentive to constant improvement of motor design, derived from the severe requirements in marine and especially automobile work, would be lost, to say nothing of the check which would be placed on the employment of small, high-speed motors in agriculture and the small industries. Of still higher economical importance, perhaps, would be the fact that the pure ethyl alcohol required in the modern chemical industries would, under the denaturing system, still be under a tax of at least 70 cents per proof gallon, which would constitute an effectual hindrance against building up these industries here, now that Germany with a lower tax and a more abundant supply of scientifically trained chemists has gained such headway—in fact, a world monopoly—as indicated by the consumption of about 55,500,000 proof gallons of alcohol (annual average since 1896 increasing at the rate of 2½ million gallons each year) for those industries alone in which denatured alcohol cannot be used.

German figures from 1902 show clearly how disproportionate is the burden of denaturing processes to the slender importance of their fiscal purpose. The classification of these figures is not complete, but such as it is, it shows that denatured alcohol was mainly employed in the manufacture of sulphuric ether, 2,943,440 gallons; powder and fulminates, 917,400 gallons; celluloid, 880,915 gallons; a variety of other articles aggregating 15,581,767 gallons; while the bulk of it, 38,309,318 gallons, was used for heating (including cooking), lighting and motor purposes. Against this stands the above mentioned consumption of somewhere near 60,000,000 proof gallons of pure alcohol for the organic chemical and allied industries, in which the denaturant must be rejected, even tho the rejection involves the extra payment of 56 cents tax per gallon.

Were the industries which would spring up and flourish in this country under free alcohol now in existence and capable of defending their rights, no power of oxen nor sense of allegiance to European precedent could drag us back to the denaturing system, and it is for the motor and automobile industries to realize that their future development is bound up more with what may be than with what is.

In this respect it is characteristic that one of the ablest papers read before the Alcohol Congress in Paris in 1903 recommended the abandonment of all denaturing processes in favor of the system by which sentinels constantly watch the entrance and exit of industrial establishments receiving tax-free alcohol, and that another speaker, Mr. Baillet, urged the necessity of getting another denaturant than methyl alcohol, in order to avoid formic aldehyde.

An inkling of what forces might be marshalled to the support of tax-free alcohol in a popular political campaign may be had from some of the facts incidentally mentioned in the foregoing remarks. Whether these forces can all be gathered more effectively for a half-measure of reform to be laid directly before Congress or for a full-measure first passing thru the initial stage of a popular agitation, is of course a question of considerable importance for the motor, automobile and motor boat manufacturer, who must await the results while the markets of the world are slipping away from his grasp—especially the rapidly growing motor trade with the tropical countries, where gasoline is natural contraband—but to elucidate this subject fully would call for a lengthy array of facts, and the final judgment of each reader would still remain largely dependent upon his temperament and habitual mode of reasoning. Whichever method and final result is preferred, there will in either case be an interim, during which it should be possible to obtain from the government a concession of tax-free ethyl alcohol for use in motor and automobile experiments, to be conducted under joint supervision by one or more government officials and the existing organizations of motor and automobile manufacturers. No better preparation than this could easily be imagined for any proposed change in the Internal Revenue system, or for any larger activity of the industries aiming for the general utilization of alcohol for motor power or only the building of alcohol motors for export.

While I am not aware that exemptions from the alcohol tax, such as the proposed experimental station would require, have been granted in this country before, they would be thoroughly in keeping with the spirit of our Department of Agriculture and our Bureau of Commerce and Labor, and in England similar departures from the general law were distinctly authorized by the Finance Act of 1902, according to which the Board of Commissioners of Inland Revenue made it known that they would be disposed to entertain favorably applications (1) from recognized bodies formed for the advancement of science, or of scientific education, and requiring to use spirit in processes of research or of illustration; (2) from persons engaged in an industrial enterprise of such magnitude and importance as to give to it a character of public interest in its bearing upon national trade.

Under certain guarantees of good faith the Revenue Department of Great Britain has even made it a practise, since the Finance Act of 1902, to permit, upon application, the use of untaxed alcohol "in new industries up to 1,000 or 5,000 gallons for experimental purposes." But in this case the alcohol is first methylated.

THE MERITS OF ALCOHOL FOR LIGHTING AND HEATING.

Constantly remembering that the actuality of all interest in alcohol as a motor fuel in America (not including Cuba, Mexico or South America, where the conditions are quite favorable to alcohol) must eventually depend upon three principal factors: (1) the intrinsic technical merit of alcohol for the purposes to which

it is desired to apply it, (2) the strength of the political forces which may be gathered in support of the contemplated revision of the Internal Revenue laws, and (3) the cost of producing and marketing alcohol in this country, with special reference, in the case of the motor industry and industries concerned in lighting and heating, to the corresponding cost of petroleum products—there now remains to be presented a few of the facts showing the commercial strength which lies in alcohol for lighting and heating purposes, and, for want of complete material, a few straggling data indicating how cheaply we may expect to produce ethyl alcohol without reckoning on such organization and centralization of the production as has been effected in Germany, and which is indispensable under the German system, but which would scarcely be feasible under our agricultural conditions.

Dispensing, for brevity's sake, with all technical analysis, we note that the French *savants*, mainly E. Sorel, recently deceased, and G. Chauveau, agree in this, that the thermic efficiency of alcohol, containing 10 per cent. of water, is less pronounced for heating purposes than for motor work, and still less pronounced for lighting purposes. At 20 cents per gallon for 90-degree alcohol and 40 cents for gasoline (76 degrees Baumé) and 32 cents for kerosene (the two latter being Parisian prices, but the alcohol in reality much higher than 20 cents at present), the economy of alcohol for both purposes would still be considerable. The unavoidable presence of water is a drawback and not an advantage, as with motors. Carburetted mixtures, including alcohols denatured with benzol, sometimes give certain sulfuric reactions which are undesirable in lamps, and these mixtures also show a plain tendency to separate into their components at low temperatures.

The advantages of the alcohol lamp are those of cleanliness, safety, brilliancy, combined with equality or slight superiority of economy per candle-power as compared with kerosene. They depend upon the suitability of the fuel (safer than gasoline, cheaper than gas, more easily evaporated, and vapors mixed with air, than kerosene) for the incandescent mantle system. When the Austrian chemist, Auer von Welsbach, discovered the principle, resulting in the Welsbach mantle for gas and kerosene, and subsequently the Auer mantle for alcohol, the alcohol lamp became at once a technical success, tho in the first applications a wick was used to draw the alcohol out of a bowl and an auxiliary flame for vaporizing the alcohol rising in the wick. This system, with later improvements, is still used for lamp burners sold to be fitted to ordinary kerosene lamps; but for hanging lamps and all outdoor illumination the bowl is placed above the flame and mantle, with gravity or pressure feed of the liquid to the burner, resulting in a free light casting no shadow of the bowl underneath.

The alcohol lamps are manufactured in all varieties of forms for household use and illumination of streets and public buildings. They radiate less heat than petroleum and give off much less carbonic acid gas, the proportion for the same candle-power being 163 for alcohol against 312 for petroleum.

This advantage of vitiating the air less than light from petroleum or gas, as ordinarily used, also applies to alcohol heaters. In the first heaters the alcohol was burned direct, but in all those now extensively sold in Germany the fluid is first evaporated and mixed with air, as in the blue-flame kerosene heating and cooking stoves, their advantage over the latter consisting almost entirely in freedom from combustion troubles.

It should here be mentioned that the alcohol motor also enjoys a considerable advantage over all other forms of power, except electric, especially for work in mines and tunnels, in vitiating the air much less. It has even been shown that an alcohol locomotive develops less carbonic acid gas in the exhaust than horses or other animals of the same work efficiency.

The extent to which alcohol, denatured with 15 per cent. benzol, is employed in Germany for lighting and heating is best indicated in the figures of the total consumption for 1902, as given earlier in this article, according to which 38,309,318 gallons were sold thru the wholesale and retail trade principally for these purposes and for motor use.

The satisfaction afforded the public by the alcohol apparatus is best shown by the increase in their use from year to year. In this respect the *Centrale*, of Berlin, gives an example in the sales from its main and branch salesrooms (exclusive of dealers supplied) for three years. The results are shown in the table.

ALCOHOL UTENSILS.	1900–1.	1901–2.	1902–3.
Small hand cookers	28,000	79,000	94,300
One-flame cooking stoves.	1,700	9,300	11,650
Same, better grade	2,200	8,000	8,900
Two- and three-flame cooking stoves	1,550	5 530	7,300
Flatirons (both tailors' and household use)	2,300	19,000	29,000
Heating stoves	....	600	3 000
Lamp burners	330	20,000	37,500
Hanging lamps	1,380	1,850	

INCREASE IN THE SALE OF ALCOHOL LIGHTING AND HEATING APPARATUS IN GERMANY.

The flatirons are self-heating, containing enough alcohol to keep them heated for two hours. The demand for this article exceeded the supply in 1902.

In the matter of the cost of producing ethyl alcohol the price of land, the conditions of the agricultural labor market, the development of auxiliary industries to dispose of by-products, the crop market, the transportation and a multitude of minor local factors, conspire to confound all accuracy of statement and general applicability of facts. In Germany dependence is placed on the potato crop, more or less reinforced by the beet crop according to the status of the beet sugar market. But Germany has 6,000 distilleries operated in connection with farms and rural estates. They produce a crude alcohol afterward refined at the large central distilleries. Lately local surplus crops of potatoes have been used for fodder, being first cut into chips and evaporated in dryers. The alcohol industry, thru prizes offered by its various organizations, has called into existence cheap evaporation processes. Thus much is done to reduce and equalize the cost of production from this crop, which is a yet an insignificant one in the United States. The potato crop of the principal countries is indicated in the following figures giving the relative production per capita of the population of each: Germany 64.3, Austria 44.8, Hungary 30.6, France 39.4, Great Britain and Ireland 12.4, Russia 33.0, and the United States 13.8.

The potato crop and its utilization enables Germany to sell 90 per cent. alcohol, denatured with 15 per cent. benzol, for 15 to 17½ cents per gallon.

As about 170 pounds of potatoes are required for producing as much alcohol as is obtained from one bushel of hard, dry, maize corn, or about 2½ gallons or 4½ proof gallons, approximately, and the residue from the corn pays for the cost of distillation, while that from potatoes is of small value, it is easy to figure the price at which potatoes must be produced in order to compete with corn at any given price for the latter. It is of course the price of the produce laid down at the distillery which counts. Roughly speaking, the proportion should probably be about one to four in the price of equal weight units of fresh potatoes and dry corn, in order to compare in economy for alcohol production, but one acre of potato land will easily produce four to eight times as great a weight of potatoes as of corn, tho the crop varies greatly according to the soil and the amount of labor put into the cultivation.

While reflecting on the meaning of these figures, it seems rather interesting to note that our government at present actually places a tax of about $5 on every bushel of corn that is converted into alcohol.

Mr. Havard, the president of the Agrarian League of France, looks to sugar beets as the main source for alcohol production in his country. He reckons that 1,540 kilograms (3,388 pounds) of beets produce 1 hectoliter alcohol (about 25 gallons) at a cost of 7.50 francs ($1.50) for the distillation and 30.80 francs ($6.16) for the beets, from which should be deducted 5 francs ($1) for the value of the plup, leaving a net cost of 33.30 francs ($6.67), so that the alcohol could not very well be marketed for less than 37 francs ($7.40), giving 37 centimes per liter, or about 30 cents per gallon. This seems rather a hopeless computation in comparison with the figures realized in Germany and the 10 cents per gallon alcohol which

should be producible in the United States from either potatoes or 25-cents-per-bushel corn.

It is stated that Cuba finds no difficulty in producing alcohol at 10 cents per gallon from the waste material of sugar cane, and a similar report is received in regard to distillation from sorghum or molasses in Kansas and from grape skins in California.

The Lignum Inversion Company, of Highland Park, Ill., employs the Classen process for making ethyl alcohol from sawdust. From 1 ton of sawdust there is obtained from 200 to 250 kilograms (440 to 550 pounds) of glucose, of which 85 per cent. is fermentable for alcohol production; and the residue of the sawdust is turned into fuel briquettes. The same method is employed in Norway, where it yields about 31 gallons ethyl alcohol at a net cost of $3.90, or between 12 and 13 cents per gallon. In the same country the alcohol distilled from potatoes comes at 20 cents per gallon.

The only legitimate conclusion which it seems permissible to draw from these data is that low-cost production of alcohol must everywhere depend largely upon an adroit utilization and organization of local conditions, but who can doubt that the distillers of the United States—those who are now in business and those who will enter the field when the tax shall have been removed or modified—will be equal to this task, greatly assisted as they will be by the great variety of agricultural products of which the soil is capable and the inclination which is manifest among American farmers toward the industrialization of agricultural work?

Letters From Practical Men.

Radial Stresses Due to Centrifugal Force in Revolving Bodies.

Editor American Machinist:

At page 1389 you published an article by Mr. A. M. Levin on the stresses in rapidly rotating disks, and at page 1572 Mr. Robert Cramer calls attention to the fact that Mr. Levin's deductions are wholly without rational basis. In an editorial foot-note you infer that there is disagreement in the deductions reached in this matter by those competent to discuss it. You state that "others beside Mr. Levin consider the stress to be uniform."

Mr. Levin's opinion in the matter is not worthy of consideration, since he arbitrarily assumes uniform distribution without any proof or other consideration of the point. The whole subject is beyond the elementary mathematics used by Mr. Levin.

Your readers will doubtless be glad to see other opinions in this matter from those competent to express one. Mr. Cramer very clearly presents some of the conclusions of Professors Stodola and Grübler, whose ability cannot be doubted. Until some logical reason is given for doubting the mathematical proofs given by these scientists, something more than the mere statement that the stress is uniform, one must conclude that most of Mr. Levin's article is not trustworthy.

SANFORD A. MOSS.

[As a matter of fact we will say that we first decided not to publish Mr. Levin's article, as we agreed with Mr. Moss that his basic assumption is erroneous. Before making a final decision, however, we submitted the article to a highly competent analyst, a former professor of analytical mechanics, who is now immediately concerned with the subject of the stresses in revolving bodies, and who had already given full consideration to Mr. Levin's problem, and he informed us that he agreed with Mr. Levin, and that his final results were identical with those published.—Ed.]

Fitting the Taper Pin in a Clapper Box.

Editor American Machinist:

At page 1434 there is a suggestion, by "Cameron," of a jig for boring the taper hole in a planer clapper box and clapper. A jig similar to the one he suggests is in use at present in the shops of the Whitcomb Manufacturing Company, Worcester, Mass. The jig has two steel straps *A* and *B* screwed and doweled to the top, and two shoes beneath them, held in position by a screw and pin as shown. The work is done in a drill press and the operations and tools are as follows, the small bushing being ⅝ inch, while the small diameter of the pin is 23-32, the large diameter being 27-32. A ⅝-inch drill is run in slightly more than half way and a 25-32 inch hole is drilled from the opposite side to meet it, after which the ⅝ hole is enlarged to 11-16 inch. The ⅞-inch bushing is then inserted in the jig and two reamers are used having a bearing in each end of the jig. The first or "hogging" reamer has stepped teeth and is milled on a spiral, the second having nicked teeth. The hole is just "touched" with a hand reamer before the work is removed from the jig. With an accurate jig the job is bound to be right.

W. E. WILBER.

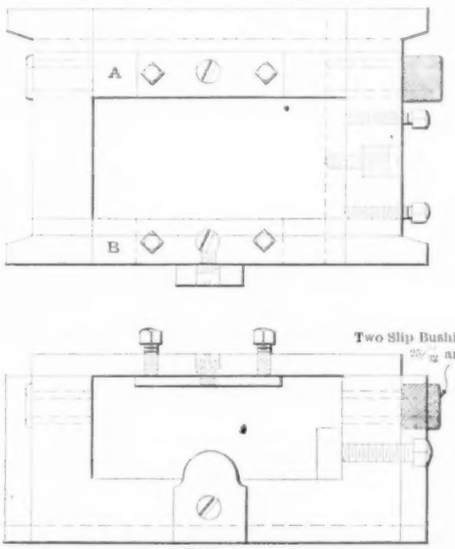


FIG. 1

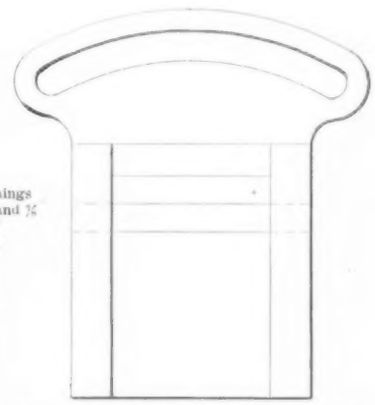


FIG. 2 CLAPPER BOX AND CLAPPER

American Machinist

JIG FOR TAPER PIN HOLE IN CLAPPER BOX.

Elements of General Drafting.

Editor American Machinist:

At page 1658 you have reviewed "Elements of General Drafting," Coolidge & Freeman.

I wish to thank you for the leniency shown in not calling attention to a great many defects which must be in evidence to anyone but the authors. In the review, however, there is one clause which I do not quite understand, viz., "some of which are insisted upon with a positiveness that is scarcely warranted by prevailing practise while others are rather minute in importance." I have been chewing on this quite a little and have come to the conclusion that you probably mean that the conventions used in the Manual are not representative of the prevailing practise. If this is the case, I might state that the "Manual" part of the book is the exact copy of the "Manual of Drawing" edited by the writer two years ago and reviewed in the AMERICAN MACHINIST, Vol. 25, page 1559. The conventions used in both represent the average practise of the shops which the authors worked up from extensive correspondence and which results were published in the AMERICAN MACHINIST, Vol. 25, page 874.

From extensive experience in the field I have observed that the young graduate possesses a very limited knowledge of drafting-room systems. Therefore it has been my purpose to teach some one system in as complete a form as possible and to use a system that is the average of the reputable drafting-rooms in the country. Since there are a thousand and one systems, all of which are different, it becomes impossible to incorporate the details of all of them in any one standard system. Independent of the system in our drafting-

room and in order to broaden the view of the students in general drafting-room systems, I have offered an elective and separate course in drafting-room systems and organization which I hope will fill in the chinks. Of course we do not expect to make finished draftsmen of the students, but hope that they will have a fair knowledge of the science or trade.

This is the first time that I have replied to a review which in most cases are not harsh enough, so will you please pardon me for this lengthy explanation which was only evoked because the authors felt that there might have been a misunderstanding in the clause referred to.

Thanking you for your kindness and courtesy, I am, C. E. COOLIDGE.

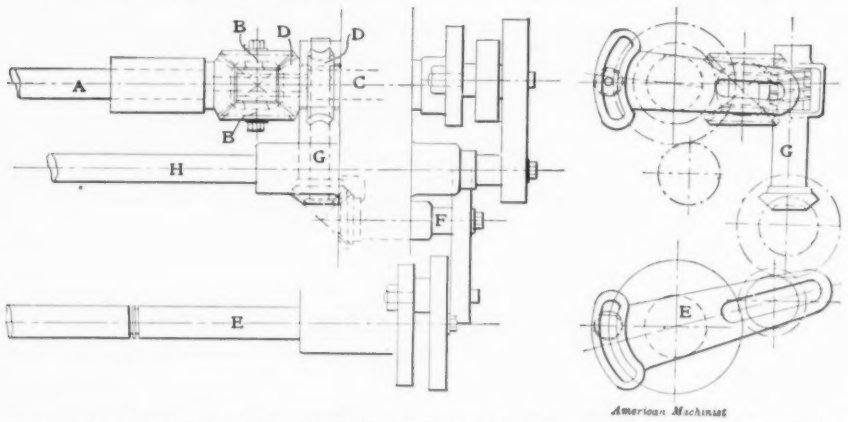
[The reviewer is unable to see any ambiguity in the words quoted, to which was added "altho as a whole they represent correctly and sensibly the usage of the shops."]

That Jack-in-the-Box Speed Change Gear.

Editor American Machinist:

I, too, have studied the subject of a variable speed changing gear for years, and was therefore much interested in the articles by various writers that have appeared recently in your journal. So far I have seen nothing new in the construction of such gears, and find that the authors of these articles have re-invented gears that have been in use these last twenty-five or thirty years. For instance, the gear designed by Mr. De Leeuw can be found on the Reinecker relieving lathe, where to my knowledge it has been in use for ten years.

I enclose a drawing of the arrangement. *A* is the driving shaft which is driven by the lathe spindle. *B B* are the two miters atached to shaft *C*. *D* is the miter connected with the worm-wheel. *E* is the leading screw thru which shaft *F* drives the worm shaft *G*. Between the leading screw *E* and the shaft *F* is a banjo plate for the reception of the change gear. The ratio of the revolutions of the shafts between *A* and *C* is 2 to 1. This ratio can naturally be increased or decreased by rotating the worm-wheel attached to miter *D* by the change gear between the shafts *E* and *F*. This simply and absolutely constitutes the gear as designed by Mr. De Leeuw.



THE JACK-IN-THE-BOX SPEED CHANGING GEAR AS APPLIED TO THE REINECKER RELIEVING LATHE.

To make the meaning of this gear comprehensible, I have to go one step further: Shaft *C* is connected with shaft *H* again by a banjo plate and change wheels. This shaft drives the cam in the center of the saddle for the relieving of cutters. All these gears are in active operation when relieving a hub cutter of rapid pitch, say, for instance, 6 inches pitch. If the teeth in such a cutter were milled straight across—that is, in the plane of the axis—one side of the teeth would have no cutting angle, while the other side of the same tooth would have too great a cutting angle. Such cutters are therefore milled with spiral grooves which approximately run at right angles to their lead and consequently necessitate sooner or later a relieving movement as the saddle advances. This is accomplished by either accelerating or decreasing the ratio of 2 to 1 from shaft *A* to *C*, by means of change gears between shafts *E* and *F*, and the worm-wheel and miter *D*.

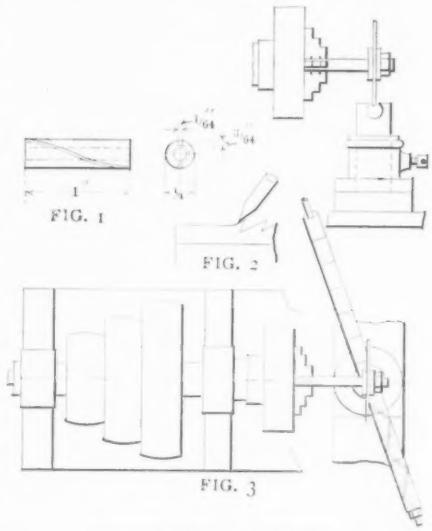
Coming back to speed-changing devices again, I beg to point out that a great multitude of such gears already exist and they are largely employed in the textile and silk machine industry. For instance, all roving frames have a speed-changing device very much allied to the one I have described, but up to now nobody, to my knowledge, has been able to design one to satisfy all the requirements of such a gear. CARL L. SCHMIDT.

Leeds, England.

Sawing Helical Grooves in Brass Tubing — Making Thin Files.

Editor American Machinist:

The article, "What a Circular Saw Can Do," at page 1428, reminded me of an expedient I used some time ago in cutting helical grooves in small brass bushings. I received an order to make 200 bushings, 1 inch long, ¼ inch in diameter, with a helical groove of 2-inch pitch, 1-64 inch wide and 3-64 inch deep, Fig. 1. The bushings were made on the screw machine, but when I wanted to cut the spiral groove I found the universal milling machine so crowded with work that I could not have my bushings out in time. As the groove was not required to be very accurate, I improvised the device, Fig. 3, to be used on a plain speed lathe.



SAWING HELICAL GROOVES.

TOOTHING A THIN SAW.

In a piece of 1-inch brass rod I drilled a ¼-inch hole, allowing sliding fit for the bushings, and fitted this brass rod in the hand-rest of the lathe. I mounted a No. 26 Brown & Sharpe saw of small diameter very carefully and set it up as shown, with the center of the hand-rest vertically under the center of the saw. The angular position of the guide hole relatively to that of the saw determined the pitch of the cut. The proper angle for the 2-inch pitch I had to ascertain experimentally by feeding a piece of ¼-inch brass rod thru the hole. Then I took a piece of drill rod, as long as I could get it, threaded it on both ends and fixed about fifty bushings on it. By feeding this steadily thru the guide hole I got a fairly uniform groove in the bushings with the pitch just accurate enough for this job. After the groove was started, the saw was guided by the groove itself, thus maintaining the proper pitch. When I got the next lot to make there was no more experimenting to get the right pitch. I put a sample bushing in the guide hole and, lifting the brass piece up against the saw, I determined both the depth of the groove and the proper angle for the required pitch. The second time it took me only three hours to set up the fixture and to cut 500 of the bushings. The groove at the end was to be made a little deeper by rounding the bottom. First I used thin files for this purpose, but the few I kept in my tool box were broken before I had rounded a dozen of the slots. As this was too expensive, I had to devise a way of getting cheaper

files for my job. I hunted up a thin clock spring and made a kind of a saw out of it. Afterward I found saws like this very useful for brasswork, and especially in experimental work for instrument makers, so that a few hints on this subject may be welcome to others.

Clamp the spring, of the required thickness, between two pieces of flat iron or brass in the vise, with about 1-32 inch projection. Then use a good, hard chisel. Hold the chisel at the necessary angle, learned by a little experimenting, and give with the hammer a blow, thus forming the first tooth (see Fig. 2). If now this tooth be examined a small burr will be noted on the forward part of the tooth. This burr serves as guide or stop to the cutting edge of the chisel in the formation of the succeeding tooth, and so on. Uniform blows of the hammer will produce a uniform row of teeth. Having so cut the required length of the spring, clamp it between two pieces of flat brass and affix a handle to it (Fig. 4). As I stated, this saw might be used in experimental work, in cutting curved slots or in cutting slots in very small screws, etc. The advantage is that clock springs are of great flexibility, have the right temper for brass work and can be procured of all sizes in many places where ready-made tools are not to be had at all. B. O. SCHOENHERR.

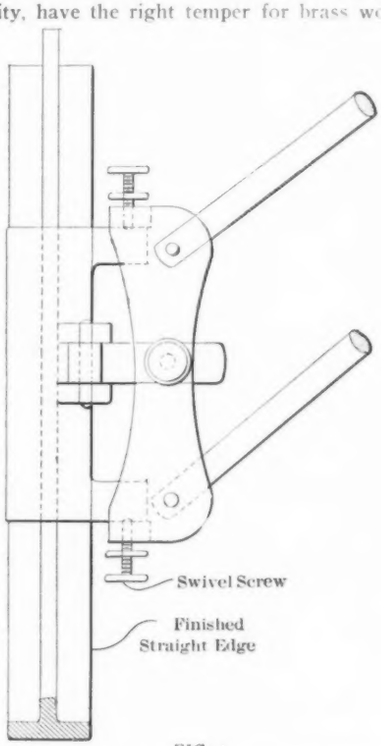


FIG. 1
A MODIFICATION OF THE UNIVERSAL DRAFTING MACHINE.

Modification of the Universal Drafting Machine.

Editor American Machinist:

An adaptation of the universal drafting machine that may be new to your readers came to my notice not long ago and, as there are no patents on it, perhaps some of your readers can find a use for it.

It was intended for drawing up car floor plans and was adapted to make drawings about six feet long by two deep, the ordinary machine being used in connection with a sliding guide and a straight-edge. The straight-edge was of tee section fastened to the board by screws from below, and made from a 1¼-inch square steel bar, the surfaces against which the guide bore being machined true. The guide was of gray iron, with a finished groove, and had projections into which the swivel screws of an ordinary head bore. Of the accompanying sketches Fig. 1 is a plan, Fig. 2 a side view, and Fig. 3 a section on the center line of the head.

The principal feature of the device was the catch lever which locked the head in place, and which is shown plainly in Fig. 3. The adjusting screw of the head bears on the end of this lever and the weight of the machine turns it about its pivot until it bears against the straight-edge, locking the guide firmly in place.

There is no reason why if a long enough straight-edge could be produced one could not draw—a map, say, a mile long, and several men could be working at the same time. Whenever it is desired to move the machine along, it is swung up and that releases the catch lever, allowing the machine to be readily transferred. Some labor and pains were necessary in the fits, but it seemed to work very well, altho for real accuracy some changes would doubtless have to be made. DRAFTSMAN.

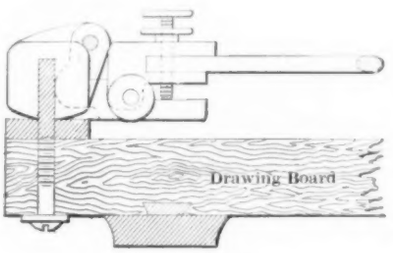


FIG. 2

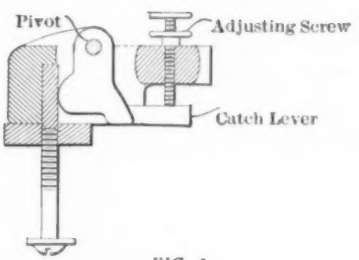


FIG. 3

American Machinist

Profitable Molding Machines

Editor American Machinist:

The article by R. O. N. at page 1539 on "giving the molding machine a chance" indicates that the writer is not familiar with the practise of some of the largest manufacturers of Chicago. Every founder who makes any pretense of being up to date uses the molding machine extensively, and the larger shops, particularly those in the agricultural implement line, have them "down fine." I know one shop in Chicago, known the world over for its pipe and fittings, which has almost the same principle of handling sand and castings as advocated by the writer referred to.

The writer further says that "the manager expects as good a return from a molding machine as from the turret lathe." I do not see why he should not have it, the cost of the equipment for each being taken into consideration.

I once fitted an internal gear, 3 pitch and 72 teeth, 2¼-inch face, to a stripping plate machine. They now pay 18 cents for molding that gear and get better castings than when they paid 60 cents on the floor. I suppose it cost about $150 to rig up, including flasks enough for twenty-five molds. One man puts up fourteen molds as against four by hand. It is true, however, that the job on the floor could have been improved by making new flasks. They made 3,000 of these gears each season for three years and still make them in smaller quantities. GEO. HALEY.

A New Way of "Laying off" Templets.

Editor American Machinist:

I called upon Mr. Alteneder, the drawing instrument maker of Philadelphia, recently, and while there he showed me a new way of laying out templets which he has devised.

This method can be applied to templets for any purpose where precision is essential. Take, for instance, the templet for the face of a narrow formed milling cutter with several curves in it; any toolmaker knows how difficult it is to scratch these curves actual size on a piece of steel. Of course it's easy enough for the draftsman to lay out the curves on an exaggerated drawing, say ten times the actual size, but paper surfaces are one thing and steel surfaces are another; there is also a difference between a drawing pen and a steel scriber. When it comes to reducing this drawing to one-tenth its size and lay it out on steel the trouble begins. It's not the difficulty of filing to a line that a man has to contend with: it's getting the line right.

Mr. Alteneder's method of laying off the lines on the steel templet comes as near absolute accuracy as can be desired. It consists of this: The curves are laid off, say, 100 times as large as the finished templet is required to be. This drawing is easy to produce—owing to its size—within, say, .010 inch of what it ought to be. It is then fastened to a board and photographed actual size. Any error which has been made in the original drawing is divided by 100. Supposing the error in the drawing to be .01 inch, the error in the actual size negative would be only .0001

inch, which is certainly close enough for most of us. After the negative is made, a piece of steel is coated with sensitive solution and the curves and other lines printed thereon photographically; the whole cost being but a few cents, and accuracy assured.

Mr. Alteneder was obliged to make a camera for this special purpose, as he found that the photographers outside the shop were not particular enough and while the print on the steel was correct in total width the curves and other lines were apt to be foreshortened, owing to the drawing not having been placed parallel to the photographic plate. With templets "laid off" by this method it is up to the man behind the file to produce a good templet by following accurately laid off lines. If a slip be made and the templet spoiled, a new "print" can be made at little expense, and as long as the negative is in existence duplicate cutters or templets can be made.

DIXIE.

Drafting Room Practise.

Editor American Machinist:

In the October number of *Power*, "An Old Hand" describes what he terms "The Commercial Draftsman," urging the young men of that profession to adopt time-saving methods in their work by leaving out all unnecesary and superfluous details and pleasing effects, thus securing favor in the eyes of their employer and more of the "long green" in the pay envelope. The author of the article, altho an employer himself, seems to forget that draftsmen are not altogether what they make themselves, but that they have been obliged, since they drew their first line, to make drawings to conform to some system, more or less elaborate, devised by their superiors. When a man has left an office where the more elaborate system is in vogue and strikes into one where most any old kind of a sketch goes, unless a fair chance is given him to change his ways, he will soon be seeking pleasanter surroundings. It's just the same on the other hand, and in either case the only way for him to win out is to follow the adage, "When in Rome, do as the Romans do." The successful draftsman is he who can adapt himself quickly to the methods and systems obtaining where he is and can turn out satisfactory quantities of work up to the standard of such methods.

I believe with "An Old Hand" that there is much unnecessary work done in many drawing rooms; that there is too much clinging to the idea that every little detail must be just so-and-so or the drawing is worthless. I have had a chance to look over the oldest drawings in several shops and have seen some beautiful pictures of machine parts in colored inks and washes, compared with which the latest drawings looked even rough, and have thought there was still chance for improvement in the saving of time. Unquestionably, every drawing room must have its own system and standards, but unnecessary elaboration is costly. The foreman who can draw the line at the neutral axis, as it were, to go either side of which means unprofitable expense, is rare indeed, yet that should be a foreman's constant goal. In the hope that what follows may be of some assistance in the striving for this ideal condition, I have jotted down what seem to me to be some of the best points in the practise of a number of drafting-rooms of recent acquaintance.

In the first place, the drawings should be made on sheets in a series of sizes, the larger of which can be folded to the dimensions of the smaller, as 9x12, 12x18, 18x24, 24x36, etc. Even tho the drawing room is fortunate enough to have space for filing all its drawings without folding, such an arrangement, when prints are to be sent away, will be found extremely convenient for envelopes of standard sizes, besides the resulting businesslike neatness.

When an order is received for a machine, more than likely the purchasing

PEN FOR FREE-HAND INKING.

party has been promised shipment on a certain date. If it is an engine or a government job, probably there is a formidable looking penalty attached to the contract, should the agrrement in this respect not be fulfilled. In any case, drawings must be had before a start can be made in the shop, and the quicker the better for all concerned. The castings are needed first, so details for the pattern shop must receive the first attention. These should not be delayed until every little oil-cup and thumb-screw is correctly provided for, but just as soon as the pattern dimensions are determined, a sketch should be sent to that department. For this a 9x12, or larger, carbon copy-book will be found very convenient. The copy can be safely sent out, the draftsman retaining the original pencil drawing for reference or very often for changing slightly and inking for a permanent drawing. Sometimes the parts may be too complicated for a sketch of this character and in such a case a paper tracing in pencil could be made from the layout as the next best way of getting the work going, which is the point to be emphasized. Having quieted the demands of the pattern shop for a time, the draftsman can make drawings of steel parts for the machine shop, stopping in time to have his drawings ready for the finishing of the castings as they come from the foundry.

If the machine being built is nearly like others previously made, prints can be made from old drawings with figures, title, etc., blocked out by pasting pieces of thick paper on the backs of the drawings to leave white spaces on the prints for filling in with ink the required changes. Two or more sets of prints are made for the shop and the drawing-room copies, and a great saving of time results. One firm I knew manufactured a certain line of machines of such a character that the parts were always of the same general outline, the dimensions alone being changed. For drawings, a set of "dummies" were made, consisting of detail drawings complete, with the exception of dimensions and a few vacant spaces in the title. From these drawings brown negative prints were made and from these, in turn, white positive prints—*i. e.*, blue lines on a white background. A stock of these latter was kept on hand and when an order for a machine came in, figures were supplied in black ink and the work speedily started. Of course, the drawings weren't to scale, but no trouble ever resulted, and besides the gain in time in the drawing room, quick deliveries could be promised. By the way, those brown prints often prove valuable as a means of preserving a copy of a drawing before being changed and of getting prints from the same. For filing away in the fire vault, the brown negatives would serve the double purpose of a record and of providing a way to obtain duplicate prints without delay, should the original drawings be destroyed. To continue, however, along the line of saving time in the drafting room, brings up the subject of free-hand inking, which I have not seen discussed in these columns. Undoubtedly, there will be numerous and vigorous shakings of heads when the statement is made that many drawings can be inked free-hand more quickly than with instruments. Such is the fact, nevertheless, altho a little practise will be necessary for personal convincement. It is not claimed that all drawings can be inked advantageously this way, especially where the scale is small and the parts of a complicated nature, but a large percentage of them can be included. It is true, also, that a drawing inked free-hand, altho surprisingly good results can be obtained, will not look quite as prim as the other kind, yet drawings are a means to an end, not artistic exhibitions. The foreman must know where to draw the line here as well as in other matters. For instance, the free-hand-inked drawing is not to be recommended for drawings sent outside accom-

panying bids for contracts, as a few extra hours spent in making a neat assembly often goes a long way toward securing the order. Some firms do not seem to realize this. In the matter of time saved, free-hand inking has the advantage over instrument inking, because there is no cleaning of the pen, no adjusting of T-square and triangles to the line and no waiting for ink to dry. I should say here, however, that unless one becomes very expert, the complete circles can be more quickly inked with the bow pen or compasses. For the free-hand work, the paper is not tacked down, but is shifted about as desired, even being turned upside down when the ink at the bottom of the sheet has not dried. A specially and easily constructed pen is used as shown in the sketch. The holder is of rubber and has a sleeve *A* for holding the pen as ordinarily used. In this case, however, scrape down the barrel *B* so two pens can be inserted as shown, one above the other. A "Judge's quill" makes an excellent pen for this work, and the combination will hold a large quantity of ink without requiring shaking off after dipping and without danger of blotting, the upper pen acting as a feeder for the lower. It is superior to the pieces of paper plan mentioned by "A Draftsman" on page 1405 of the AMERICAN MACHINIST. In drawing, the pen should be held at right angles to the position for writing—that is, it should be parallel to the line drawn, as shown in the elevation view of the sketch, while the hand itself rests naturally on the paper. With some practise, wavy lines will disappear, speed will come in proportion and there will be a certain pleasure in this departure from mechanical aids.

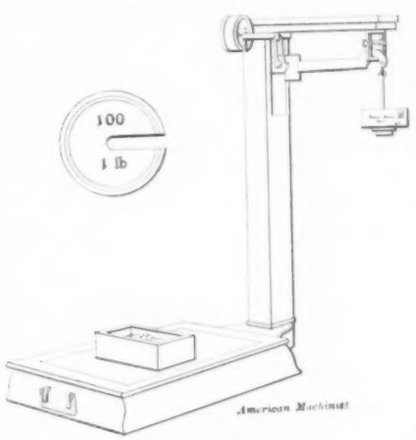
In sectioning areas, much time can often be saved by using colored or black lead pencil. Apply the same freely and rub into the paper or cloth afterward with a soft eraser. This shows up well on the print and will not easily come off the drawing. If there are a number of contiguous parts, however, to be sectioned, use the free-hand pen, very often not drawing the lines clear across the area, but making short strokes along the edges, thus sharply defining the lines dividing the pieces. In regard to ink for the free-hand work, Higgins' "Eternal" brand, altho not such a dense black as the India, flows more freely and will often answer as well.

Some firms make a practise of putting red lines along surfaces to be finished, which requires that the prints be gone over with red "soda ink." Even tho this latter is left to the blueprint boy, the result must be checked by the draftsman, and all this requires time. An "f" of conspicuous dimensions, or the words "Bore," "Turn," "Face," etc., answer every purpose and add hours to the credit side of the department's time records. Speaking of prints, the correct way to change them is by the use of the soda solution, and not by the corroding "Chinese white." The solution, however, should be applied *after* the print has been corrected with India ink, as the ink is not affected while the blue background fades away. CHIPS.

Small Business On a Large Scale—Weighing Backward.

Editor American Machinist:

The ordinary platform scale such as we so commonly see at the farmer's, the storekeeper's, the miller's, or the freight houses, is not usually graduated to weigh to a smaller unit than ¼ pound. Sometimes the farmer wants to weigh a letter or a package for the post office, or the country storekeeper has a call for an ounce of nutmegs—can they weigh them on scales of this description? Certainly; platform scales, especially of Fairbanks make, are designed so that 1 pound of weights hung on the tip of the beam will balance some definite amount, usually 100 pounds, on the platform. This ratio is commonly indicated on the weights. Knowing this, it is only necessary to place the letter or package on the counterpoise and then to place enough of any available material on the platform to balance the scale. Remove the letter, weigh the load on the platform in the usual manner and divide this amount by the ratio, in this case 100. For example: suppose the weight of the material which just balances the letter to be 5¾ pounds, then $5.75 \div 100 = .0575$ pounds. Reducing this to ounces, $.0575 \times 16 = .92$ ounce, which is the weight of the letter. On the other hand, if we wish to weigh out exactly 1 ounce of something, we have only to remember that it will require 100 ounces on the platform, or $100 \div 16 = 6\frac{1}{4}$ pounds to balance one ounce.



WEIGHING A LETTER.

If the ratio of the weights is not known, it may be found by weighing one of the weights. If the weight which is marked 100 pounds weighs 1 pound, the ratio is of course 1 to 100, or if the 100-pound weight actually weighs ½ pound, the ratio is 1 to 200.

Where made to the metric system the calculations can of course be made mentally from one denomination to another. For instance, if 27 kilos are required on the platform to balance the weight on the counterpoise, then the latter is .027 gram; or, .27 decigram; or, 2.7 centigrams; or, 27 milligrams. W. H. S.

Editor American Machinist:

How often, when we are trying to arrive at our costs, do we find that small machine parts cannot be weighed accurately on any scales about the factory because the scales are not sensitive enough, nor graduated finely enough for the purpose?

When we want to find the weight per hundred or per thousand, or how many run to a pound, we generally have to guess at it, and so run chances of multiplying errors a hundred or a thousandfold; or, we send out to the nearest druggist or jeweler's store, get the weight in troy or apothecary's units, and then get a headache translating it into avoirdupois weight. And the same thing applies whenever we want to weigh out proportions in mixing metals, or in the thousand and one other cases which may arise in a shop in the course of a year.

But all this is quite unnecessary. The big platform scale in the machine shop is quite capable of doing the work if we will stop and think for a moment on its construction.

Most scales are so designed that the leverage is 100 to 1—that is, if a weight weighing 1 pound be placed upon the pendant at the end of the beam, it will exactly balance 100 pounds placed upon the platform. And if a weight of 1-100 of a pound be placed upon the pendant it will balance 1 pound upon the platform.

Suppose, now, we have a very small casting, finished or not, or a very small machine part of which we want to get the exact weight to figure on a large quantity. Placing it upon the pendant we proceed to pile upon the platform any small, convenient weights or articles until the scale balances. We find the weight of the material we have piled upon the platform to be 3 pounds; the weight of the part would then be 3-100 of a pound, or 100 of such parts would weigh 3 pounds.

Perhaps the most convenient method to use is to balance a small pail on the platform, and then to pour water into it when ascertaining the weight of the different parts. But there is no reason why it cannot be used as above described with any odd material at hand, and the basis of hundredths, instead of common fractions, will materially help the cost-keeper in multiplying his quantities and keeping his fractions uniform.

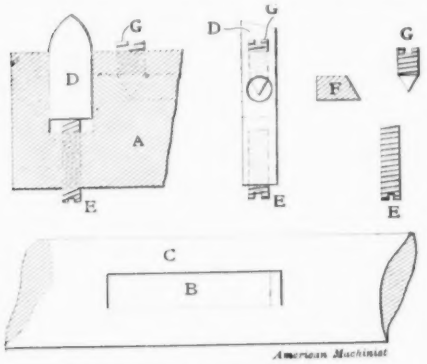
Suppose now again that we wish to weigh out very accurately a proportion of 5-100 of a total weight of 10 pounds which is equal to half a pound. Pile enough material on the platform to balance 50 pounds on the beam, and then, attaching a thin paper receptacle to the pendant, pour out the powder or whatever it is

which is to be weighed into this paper until the scale balances; and so on, for whatever purpose the information may be required. G. D. H.

An Improved Single-End Cutter.

Editor American Machinist:

The sketch illustrates a device I made to eliminate unnecessary work, and for doing more accurate work with single-end cutters. I think it is superior in every respect to the old method of holding the cutter with key and setting a cut with a hammer and punch. It consists of a machine steel block *A* to fit the hole *B* in the boring bar *C*, having one side taper, as shown in the sketch, with a slot cut thru it for receiving the square cutter *D* which may be of any length consistent with diameter of bar. The set-screw *E* is for adjusting the cut and *G* for engaging a pin *F* to lock the cutter *D* in position. In this block ¼-inch screws, 20 pitch, give you .050 to one turn of the screw, almost micrometer accuracy. By the old method you do not know whether you are getting .001 or .050 when you take in consideration



AN IMPROVED SINGLE-END CUTTER.

the spring of bar when struck with a hammer. Another good feature is that you can use a very short cutter, being economical with steel where it would be impossible to use the same piece with the old method. Wm. S.

Reducing Time on Work by Accurate Time Study.

Editor American Machinist:

Having read everything I could get hold of during recent years in regard to machine shop management, and particularly articles and booklets on the premium plan and piece work, I have come to some conclusions that may be at least suggestive to other shop managers. While not thru with my efforts or experiments, I have imbibed a considerable respect for the prejudice of the average machinist against either of these systems. I do not mean to say that the machinist is reasonable in the matter nor do I condemn him unqualifiedly, but the prejudice is deep-seated and must be reckoned with.

That some better way is necessary than leaving it to the man working by the day to determine what work a man should do is shown by such examples as the following: A shop manager told me to-day that he had run a shop on piece work and that they had based the piece-work time on just half of what it was under day's work, and that some of the men were soon earning $10 per day. While this is a pretty bad showing, yet any man who has concentrated his attention on finding out just how quickly a piece of work can be done has made such betterments as will incline him to believe that the reduction in time implied by the above increase in wages is not only possible but would be duplicated in a host of shops if intelligent effort and adequate stimulus in the way of wages were enlisted in an effort to reduce time to the lowest possible limits.

It will be granted that the purpose of all the systems is to get work done in the shortest possible time and that if a shop should adopt the method of my friend and simply cut day's-work time in two as a basis for piece work, it is conceivable that the man who had been soldiering would increase his wages beyond reason, while an honest and efficient man might be put out of business if his rate were fixed on the same basis.

My conclusion is that in a certain sense piece work or the premium plan is adopted to determine in how short a time work can be done; that the introduction of either the piece or premium system will be opposed by the men in every possible way, and that in some shops it will be found practically impossible to introduce them. This brings us to the question of whether there is any other way that the information can be obtained, and I answer from experience that any shop foreman can reduce the time on work wonderfully by accurate time study. This is the idea of Taylor, Gantt and others, and not my own, but I speak as a disciple and not as a teacher when I say that if you will get a stop-watch, analyze the work by dividing it into its elements, get your foremen doing the same thing, get your good men doing it, you will be surprised at what you can accomplish in the way of time reductions, even under the day's work system.

I have applied the system to a wide range of work, from handling pig iron and coal to lathe and planer work, and the most striking thing developed in the effort is the woeful lack of exact knowledge on the part of men, foremen and superintendents as to the time necessary to do a good job. On a coal-handling job an intelligent foreman estimated fifteen minutes for a certain operation; the stop-watch showed it to be three minutes, and this one investigation resulted in the elimination of one man, an increase of 15 dollars per month to the other and a corresponding gain to the firm.

Another man found that repeating a certain operation twenty times per day was too much for him; investigation showed that a man, working at a rate of speed that a good man could keep up for a full day, could perform the work in three-fifths of a day, having two-fifths for rest, a much larger rest period than would be tolerated if persons responsible for the work knew that it was being taken.

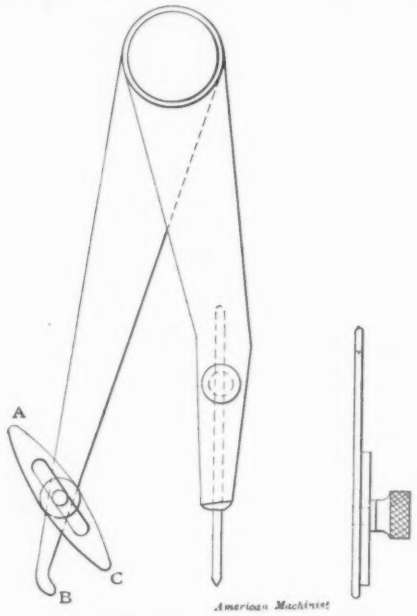
Absolute knowledge acquired by accurate time study as to what constitutes good time on a job is wonderfully helpful in cutting down the time taken.

Anthony Stafford.

An Improved Morphidite Caliper.

Editor American Machinist:

The illustration shows an improvement on a pair of morphidites. *A* is a little attachment to be used on the leg. Any-



AN IMPROVED MORPHIDITE CALIPER.

body who has used morphidites knows there is a tendency for *B* to slip down unless extra care is used. With this attachment by having the point *C* resting on top of the piece to be marked and the point *B* on the side, the line is bound to come straight, and numerous lines can be drawn on the same piece the same distance apart. This attachment is not bulky and can be adjusted at any angle.

Patrick J. King.

A big hospital in London has in front of it a clock face with a statement that the expenses of the institution amount to one penny a second ($1,800 a day) and inviting the visitor to take the entire support of the hospital on to his shoulders for that space of time. The hand of the clock is automatically advanced one second for each penny dropped in. A gramaphone is to be added to say "Thank you" in the voice of King Edward.

What is said to be the largest bandsaw in the world was recently made to order by Henry Disston & Sons, Philadelphia. It is 17 inches wide, 50 feet 3 inches long, 13 gage.

Internal Grinder.

This machine, which is built by the Faneuil Watch Tool Company, Brighton, Boston, Mass., is a development of its smaller or bench grinder, and is equipped with the same form of swiveling head and same type of work spindle as used in that machine. It is designed especially for internal grinding and particularly for operation in holes up to, say, three or four inches diameter, tho it will swing work as large as 6 inches in diameter and will grind to a depth of six inches. The wheel slide may be swiveled to any required angle and is operated by a hand-wheel

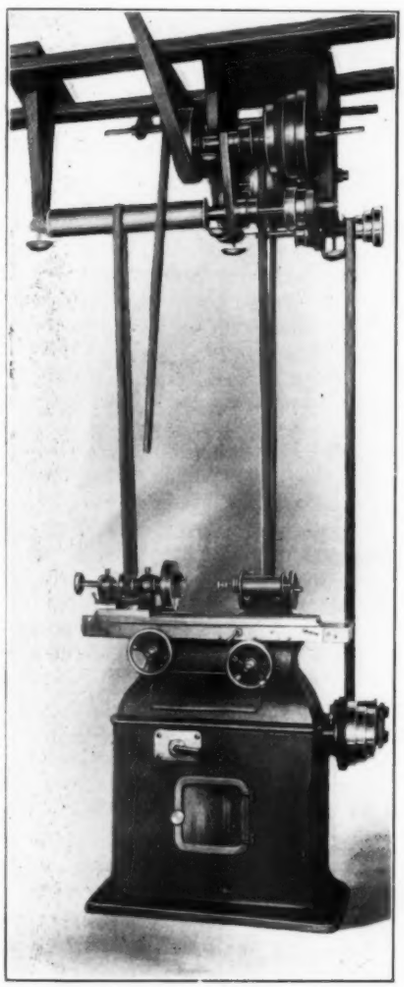


FIG. 1. INTERNAL GRINDER.

shown at the front in Fig 1. The work table, which is also arranged to swivel, has an automatic reciprocating action and may be traversed by hand thru hand-wheel, pinion and rack. The quill for the wheel spindle is arranged as in Fig. 2, this construction, which embodies the Rivett type of bearing, allowing the spindle to run at speeds as high as 75,000 turns per minute. End thrust is taken by the centrally located collar on the spindle, which collar runs between anti-friction washers abutting against adjustable sleeves *A*; and adjustment of the split bearings *B* is made by means of sleeves *C* which are moved endwise independently by opposing screws, each of these sleeves acting upon three wedges which are concaved at the bottom to fit the box and serve to adjust the latter nicely to the spindle as sleeve *C* is slid endwise. Two elastic belts drive the spindle, one of these passing over a pulley at each end; the speed range secured by the cone pulleys gives rates of from 20,000 to 75,000 turns per minute. The reciprocating mechanism for the table is shown in Fig. 3 and consists mainly of a heart-shaped cam carried on a vertical shaft and acting upon an adjustable contact roll carried by a rocker arm whose upper end is connected by a link with a reciprocating block which may be at will connected to or disconnected from the work table or slide. The roll is held against the cam by springs, as indicated. The cam is of a considerable depth and tapers from top to bottom and the length of stroke may be varied from 0 to 6 inches by turning a handle shown at the front of the bed in Fig. 1, this handle operating a shaft, which, thru the bevel gears and screws

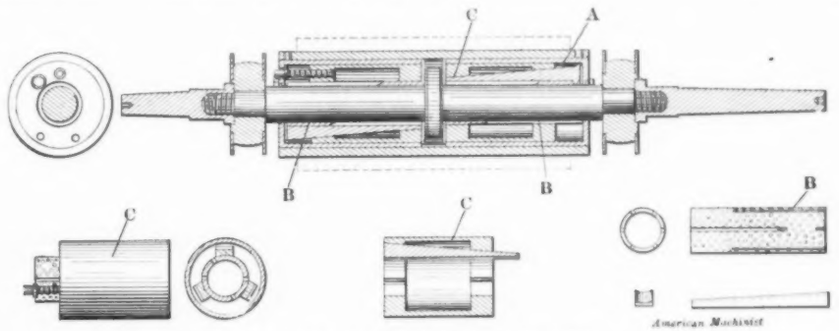


FIG. 2. THE WHEEL SPINDLE AND QUILL.

arranged as shown in the line cut, adjusts the contact roll carrier along the face of the rocker arm. The cam is so laid out that as the center of the stroke is approached—that is, as the wheel cuts toward the middle of the work—the rate of traverse is slightly retarded, the movement being correspondingly accelerated immediately the central point is passed, thus obviating any tendency there may be for the wheel to cut smaller at the center of the bore, and at the same time allowing a coarser rate of feed in general to be employed. The drive for the reciprocating cam is thru the bevel and spur gearing shown in Fig. 3 and the four-step cone shown at the side of the machine in Fig. 1, the driving belt passing under two idlers mounted directly back of the pulley.

The reciprocating block is attached to the table by a clamp whose handle is shown at *D*, Fig. 3. This clamp is dropped into a slot formed in the under side of the table, and it is obvious that no matter how tightly it may be set up there is no possibility of its springing any working part. By releasing the clamping member the table may be stopped at once without stopping the machine, and by the hand-wheel to the left in Fig. 1 may be run back by hand for admission or inspection of work. A stop (not shown) is provided at the left-hand end of the table and this forms a locating medium by which, after the table has been released and run back to allow a hole to be gaged, it may again be slid forward exactly to its former position, so that when it is again clamped to the reciprocating block the wheel will cut to precisely the same depth as before table

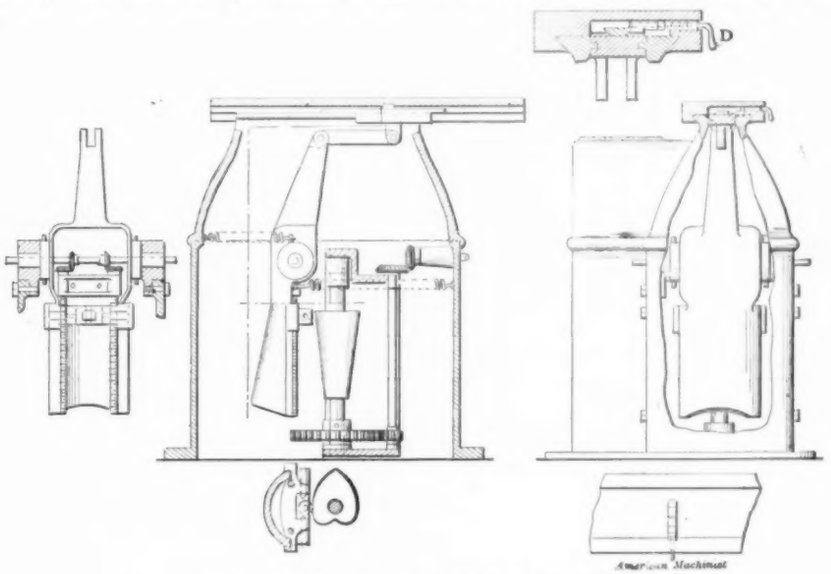


FIG. 3. RECIPROCATING MECHANISM FOR TABLE.

and block were disconnected. The stop also forms a means by which the position of the table and hence of the work relatively to the wheel may be adjusted to a nicety. The general view in Fig. 1 shows clearly the arrangement of the overhead works with the various cone pulleys for varying the velocity of wheel and work spindles and for operating the table at any desired rate of speed.

Hydraulic Cylinders and Stuffing Boxes.

BY A. D. WILLIAMS.

The accompanying tables give the proportions for hydraulic cylinders, their stuffing boxes and flanges for a working pressure of 500 pounds per square inch. They are not original, and I am not posted as to who is guilty, but they have been used extensively and the results have been satisfactory.

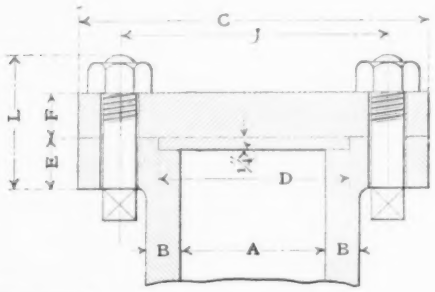
The stuffing boxes are designed for studs. In many cases it is necessary to use T-headed bolts set in slots which leave the end of the cylinder clear and greatly facilitate repacking, particularly in cramped surroundings. The proportions given do not apply to this construction. Some designers prefer to bevel the bottoms of the packing recess and of the gland.

The flanges shown are proportioned for T-headed bolts. Studs, while much used for cylinder heads, are not desirable in rolling-mill work, but can be used if desired. If hexagon or square-headed bolts are to be used, the flange dimensions must be increased.

For single-acting plungers it is not necessary to bore the cylinder its full length, the finished bore in this case being made of a length equal to once or twice the diameter of the plunger, and the balance being chambered out larger. Allowance must be made for this in designing the cylinder. A tit should be left on the end of the plunger so that it cannot bottom.

Hydraulic power is extensively used around a steel works, the usual working pressure being 500 pounds, and where heavier pressure is necessary an intensifier is used.

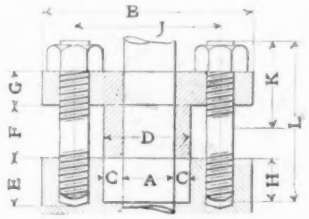
Mr. W. T. Sears gave in the AMERICAN MACHINIST at page 49, Vol. 20, a diagram comparing a number of formulas for the thickness of cylinder walls, and these tables are apparently based upon this diagram and upon the assumption that the safe tensile strength of gray iron is 2,500 pounds per square inch.



ALL DIMENSIONS IN INCHES

A	B	C	D	E	F	BOLTS—T HEAD No.	BOLTS—T HEAD Dia.	BOLTS—T HEAD L	J
3	¼	7½	4	1¼	⅛	4	¾	3	5½
3½	⅛	7⅝	4½	1½	1	"	"	3½	6½
4	"	8¼	5	"	"	"	"	"	6¾
4½	"	9⅛	5⅝	"	"	"	⅞	3⅝	7⅞
5	1	10½	6	1⅝	1½	"	"	3⅞	8½
5½	"	10¾	6⅛	"	"	6	"	"	8¾
6	1¼	11½	7⅛	1⅝	1⅝	6	"	4⅛	9⅛
6½	"	12	8	"	"	"	"	"	10
7	1½	12¾	8⅛	1⅝	1⅛	8	"	4⅝	10¾
7½	"	13⅜	9	"	"	8	1	4⅛	11⅜
8	1⅝	14⅜	9⅛	1⅞	1⅝	"	"	4¾	12⅛
8½	1⅝	14⅞	10	"	"	"	"	"	12⅝
9	1⅞	16	11	2⅛	2	"	1⅛	5⅛	13⅝
9½	"	16½	11⅛	"	"	10	"	"	14
10	"	17	12	"	"	"	"	"	14½
10½	"	17⅛	12⅛	"	"	"	"	"	15
11	1⅛	18½	13	2⅜	2⅛	"	"	5⅛	15⅝
11½	"	19⅛	13⅛	"	"	"	1¼	6	16⅛
12	"	20	14	"	"	"	"	"	17¼
13	1⅝	22	15	2⅛	2¼	"	1⅜	6⅛	18⅛
14	"	23	16	"	"	"	"	"	19⅛
15	"	24	17	"	"	"	"	"	20⅛
16	2	25⅛	19	2⅛	2⅛	12	"	7	22¼
17	"	26⅛	20	"	"	"	"	"	23¼
18	2⅛	28⅛	21	3⅛	2⅛	"	1⅜	8⅛	25
19	"	29⅛	22	"	"	"	"	"	26
20	2⅛	31⅛	23	3⅛	3⅛	14	"	8⅛	27⅛
21	"	32½	24	"	"	"	"	"	28½
22	2⅛	33⅛	25	3⅛	3⅛	16	"	9¼	30
23	"	34⅛	26	"	"	"	"	"	31
24	3	36½	27	4	3⅛	18	"	9⅞	32½

HYDRAULIC CYLINDERS AND FLANGES FOR 500 POUNDS PRESSURE.



ALL DIMENSIONS IN INCHES.

A	B	C	D	E	F	G	STUDS No.	STUDS Dia.	STUDS H	J	K	L
1	4½	⅜	1⅜	1½	1	⅜	2	⅜	1	3	1⅜	3⅜
1½	4½	"	2	"	"	"	"	"	"	3½	"	"
1½	5½	½	2⅛	1⅜	1½	"	3	"	"	4	2	3⅜
1⅝	5⅜	"	2⅜	"	"	"	"	"	"	4½	"	"
2	6½	⅝	3½	2	1⅛	⅝	"	⅝	1½	5	2⅜	4⅜
2½	6⅜	"	3⅜	"	"	"	"	"	"	5½	"	"
2½	7	"	3⅝	"	"	"	"	"	"	5½	"	"
2⅝	7½	"	4	"	"	"	"	"	"	5⅝	"	"
3	8	⅝	4½	3	2	⅝	4	"	"	6½	3	5
3½	8½	"	5	"	"	"	"	"	"	7	"	"
4	9	"	5½	"	"	"	"	"	"	7½	"	"
4½	9½	"	6	"	"	"	"	"	"	8	"	"
5	10⅝	¾	6⅝	3½	2⅛	1	"	¾	1⅛	9	3⅜	6
5½	11½	"	7½	"	"	"	"	"	"	9½	"	"
6	11⅝	"	7⅝	"	"	"	"	"	"	10	"	"
6½	12½	"	8½	"	"	"	"	"	"	10½	"	"
7	12⅝	"	8⅝	"	"	"	"	"	"	10⅝	"	"
7½	13½	"	9½	"	"	"	"	"	"	11½	"	"
8	14	"	9⅝	4	3	"	6	"	"	12	4	6½
8½	14½	"	10½	"	"	"	"	"	"	12½	"	"
9	15	"	10⅝	"	"	"	"	"	"	13	"	"
9½	15½	"	11½	"	"	"	"	"	"	13½	"	"
10	15⅝	"	11⅝	"	"	"	"	"	"	14	"	"
10½	16½	"	12½	"	"	"	"	"	"	14½	"	"
11	16⅝	"	12⅝	"	"	"	"	"	"	15	"	"
11½	17½	"	13½	"	"	"	"	"	"	15½	"	"
12	18⅛	1	14	5	3½	1⅛	"	1	1⅛	16⅛	4⅛	7⅛
13	19½	1	15	"	"	"	"	"	"	17⅛	"	"
14	20½	1	16	"	"	"	"	"	"	18⅛	"	"
15	21½	1	17	"	"	"	"	"	"	19⅛	"	"
16	23½	1⅛	18½	6	4	1⅛	"	1⅛	2	21½	5⅛	8⅛
17	24½	"	19½	"	"	"	"	"	"	22½	"	"
18	25½	"	20½	"	"	"	8	"	"	23½	"	"
19	26½	"	21½	"	"	"	"	1⅛	2⅛	24	5⅞	9⅛
20	29½	1⅛	23	8	"	1⅛	"	"	"	26	"	"
21	29½	"	24	"	"	"	"	"	"	27	"	"
22	29½	"	25	"	"	"	"	"	"	28	"	"

HYDRAULIC STUFFING BOXES FOR 500 POUNDS PRESSURE.

The Commercial Status of "Pure" Science.

We take the following from an address of unusual suggestiveness, entitled "Some Difficulties in Getting On," by J. Swinburne to the students of the Institution (British) of Electrical Engineers:

It is but human to glorify one's own office. The result is that the attitude of the science teacher in this country is that of a real, tho unavowed, antagonism to the scientific development of the industry of the nation. Science for which no use has been found, or which is not applied, is called "pure science," whereas it is really the raw material, and should be called "raw," or "crude science." There is an assumption of superiority in the term "pure science," and generally the term "science" is appropriated by workers in raw science in much the same way as the

term "working man" is appropriated to the exclusion of brain workers. There is supposed to be something noble and superior about "raw science," and its study is treated as the unselfish devotion to the interests of man, which is obviously entirely the wrong way around. The so-called "scientific man" thinks that engineers and manufacturers are ignorant and unscientific, and that their practical knowledge is of no account; and that the cure for all industrial evils is more technical education, more universities, and more power to the science masters.

I would earnestly urge any of my hearers who has the idea that there is something noble and superior about "raw science," or who thinks little of business men, to get rid of all such notions if he hopes ever to get on. If you look round the electrical industry, or round the industries generally, who are at the top? Always the business men. The men at the head of large industries generally know very little science. A man may run a large electrical industry with the most vague ideas as to the true relation of the electrostatic and electromagnetic systems of units; in fact, he may think power, force, and energy are very much the same kind of thing if looked at in a broad, common-sense way, without any scientific prejudice. If he wants good technologists, he employs them; if he wants practical men who can take commercial responsibility, he pays good salaries; if he wants men full of book knowledge, he pays low salaries, but he does not generally want them. Raw scientists—to coin a horrible word for a most estimable class—tell him he knows nothing about science, and therefore does not know how to run a scientific business, and tell him to subscribe to universities, which are so inefficiently worked that they have to beg, like hospitals, and to employ young men from the technical colleges. He either takes no notice, or he gets annoyed at their superior attitude, and discharges a couple of scientific men, and puts their saved wages toward the salary of a new practical chauffeur, and enjoys himself. Yet the science teacher looks down with contempt on the engineer as an ignorant, rule-of-thumb, inferior person, and the engineer in his turn looks down on the business man as a money-grubbing person with no brains and no lofty ideals. But this is all topsy-turvy. The business man at the top, the practical engineer in the middle, and the unpractical engineer, or the raw scientist, at the bottom. The business man may have no knowledge of the ways of Nature, but he has a knowledge of the ways of man—a knowledge which is infinitely more difficult to acquire, and infinitely more difficult to employ well. His brain may be different from that of the scientific man, but there is no reason to suppose that it is less. Its convolutions may be different, but the probability is that they are even more complex than those of the scientific man.

A man's value to the world at large may generally be roughly estimated by the income he earns. Where position is earned at the same time, the money income is, in proportion, less for a given usefulness; but taking such disturbing elements into account, the rule is broadly true. The business man comes out far above the engineer. He employs the engineer; the scientific man is his servant. Just as the raw scientist looks down on the engineer, and the engineer looks down on the business man, so the business man has a contempt for the engineer; and the engineer in his turn looks on the raw scientist as an unpractical crank. So much is this the case that the business man will not trust the engineer more than he can help. He assumes that if you know anything about anything, you cannot possibly be a business man. I remember a board of directors finding fault with a report of mine because I said that making a certain article would pay. They said such a statement was outside my province altogether, as I was a scientific man, and therefore could not possibly know whether a manufacture would pay, as that is a business question. As a matter of fact, I had at one time charge of a factory for making the article in question; but that did not matter. I was scientific; therefore it was not possible I could have any commercial sense. Now, how has such an idea come about? Is it not because scientific people profess such contempt for business that they do not trouble about it, and thus remain so useless that such ideas as those of my board are based on a foundation of truth.

If you examine the large industries you will, as I say, find the commercial or business man, with little or no technical knowledge, at the top of the tree. If you confine your attention to engineers, you will find the engineers who make the biggest incomes and occupy the most important and responsible positions are those who have most business or practical knowledge. Our leading consulting engineers do not spend a large portion of their lives plotting curves, counting electrons, or even making anything more than arithmetical calculations. They spend their time dealing with large questions on purely commercial lines; and as a rule the bigger the engineer the more he knows about practise and business, and the less he knows about text-book science. I do not for a moment mean to say that text-book science is not of priceless value; of course it is; and the more scientific knowledge you or I, or, still more, the leading engineers have, the better; but most of us suffer from too little common sense in proportion to our scientific knowledge.

A writer in an English contemporary, in discussing the wastefulness of high temperature up-take gases, refers to the alleged fact that under certain circumstances there is a waste going up the smokestack of 500 horse-power *per hour*. And a man, with such a conception of horse-power, apparently expects his treatment of horse-power subjects to be taken seriously.

Charles Vander Woerd.

The *American Jeweler* is printing an interesting series of articles detailing the history of the development of modern American watch manufacture, and from it we take the following account of the life of a mechanic and inventor in that line who incidentally left his mark upon the machine tools of the general shop:

Chas. Vander Woerd was another example of the skillful mechanic and inventor who was associated with the Waltham factory in the building of its first semi-automatic machinery. He was born in Leyden, Holland, and early in life came to America; was at one time employed at the Seth Adams Sugar Refinery, in South Boston; later he worked for Alvin Clark, of Cambridge, on telescopes; from there he was induced by Mr. Moseley to enter the employ of the then "Boston Watch Company," at Waltham. He possessed a power of ready perception, as well as a good knowledge of mathematics, and was able to acquire a fair knowledge of astronomy, which in after years he utilized in the establishment of an observatory for the securing of exact time rate for the accurate timing of the watch movements made by the Waltham company. The transit instrument was made by Clark & Sons in conjunction with the machine shop of the watch company, and while not a large one, is of high grade and fine accuracy, and has been in constant use for about twenty-five years, and is believed to be the only instrument of the kind in the world forming a part of the equipment of a watch factory. In 1864 Mr. Woerd invented an automatic pinion cutter, which, having been modified and improved, is still in use. In 1869 he modeled the Waltham company's first "Crescent Street" movement. In 1874 he invented the automatic screw machine, which attracted much attention at the Centennial Exposition in Philadelphia and the Inventions Exhibition in London in 1885. In 1873 he designed and patented a modified form of "slide spindle lathe," which was nominally a two-bearing lathe, but it was never a satisfactory form of construction and was abandoned. He became superintendent of the Waltham factory in 1876, which position he retained until his resignation in 1883. After severing his connection with the American Waltham Watch Company he engaged in the manufacture of watch tools, and later the business was changed to the manufacture of watch movements, and developed into what is now the United States Watch Company.

Mr. Vander Woerd in 1888 became interested in a California mining enterprise, and while traveling in December of that year, he died suddenly in a railroad train.

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For the New Year.

With this last number of the old year we venture to express the hope that the coming year will see a continued development of the increased business which during the past few months has taken place, and that all our readers and friends will during the coming year be prosperous and happy.

Needless to say, the AMERICAN MACHINIST, which is now well advanced in the twenty-eighth year of its existence, will go on about as usual. We have no plans for startling innovations, but will make some minor changes in typography and make-up, and will continue to get and print the best articles to be obtained about machine shops and the work done in them. Among the notable articles planned for the coming year will be a series illustrating and describing the United States Arsenal at Rock Island—a very interesting manufacturing plant in which a great many very interesting things are done. This series will begin early in the new year, and will, we think, be one of the most interesting and valuable series of articles we have ever published. We shall continue to invite our readers to send us accounts of interesting or instructive shop affairs, and know from past experience that the invitation will be liberally accepted. Not only from American shop men, but from those of nearly all other lands in which machinery is built as well, we are receiving an increasing number of communications of the most interesting and valuable kind. We are of course glad to be the means of thus bringing the good mechanics and engineers of all lands together, and are glad to be able to say that in Europe alone the number of our readers is equal to what is often regarded as a large circulation for a technical journal. We could not take satisfaction in this if we did not sincerely believe that all such means of interchange of thought and experience between people living in different lands is good for all who participate in it. Being interested in the same things brings people closer together, removes misunderstandings, tends to promote peace and friendliness, to make us realize the fact that we are all brothers, and that a good fellow is none the less a good fellow because he lives in a far distant land and speaks a strange language.

The Lawson Disclosures and the Machinery Business.

As we go to press with this, the last number of the year, the air of New York and Boston, together with the chilly spaces lying between, is agitated by accusations, recriminations, threats and dire predictions of disasters to befall, all based upon the letters of one man to one magazine, supplemented by certain lurid advertisements purporting to be published in the interest of the public and announcing that certain men dare not defend themselves, and that certain stocks are bound to fall in value, etc.

Much is being made of Lawson's accusations against the "Standard Oil crowd" and most people will be ready to believe all he says of them, because among other reasons there is so much corroborative evidence in Lloyd's famous book which gives a history of the Standard Oil Company and in Ida Tarbell's book devoted to the same purpose. Another fact that tends to confirm belief that Lawson's most serious charges of nearly all kinds of rascality are true is the fact that the ever-ready injunction has not been called into play to prevent the publication and circulation of these stories, tho their publication has caused tumultuous times in Wall Street and very great shrinkages in values of stocks held by powerful kings of finance.

One of the most curious features of the whole affair perhaps is the fact that Lawson's charges, after all, consist of statements to the effect that certain manipulators led certain investors to believe that certain stocks in copper mining companies were worth more than they actually were worth, or more than the manipulators had paid for them. But practically the same thing is done every day by "honest and horny-handed farmers" trading horses. Nothing is thought of it because it does not concern the general public. Commercial usage the world over sanctions the practise of the seller exaggerating more or less the value of what he has to sell and getting all he can for it. The important point to be considered by the public in connection with Lawson's revelations is that these men were trading in and cheating each other in the sale and purchase of a special privilege bestowing upon the holder a monopoly—*i. e.*, the legal right to plunder his fellow-men. Copper, for instance, has always been more or less of a necessity. Since the phenomenal development of the electrical industries it is a prime necessity of our modern life. When these men were, as described by Lawson, conspiring to defraud the investing public and at the same time plotting to take advantage of each other, in defiance of the saying that there is honor among thieves, they were simply endeavoring to make innocent investors believe that the privilege of "holding up" and exploiting the electrical industries of the country and thru them all other industries was worth more than it actually was worth. The concern of the public would seem to be with the question of the monopoly rather than with the question of whether or not a given set of men did or did not pay too high a price for it. It makes little difference to the ass whether his owner paid too much for him or not. The ass is a slave just the same and is an ass just the same.

We are impelled to comment upon these matters because the case seems a brilliant example of the difference between legitimate, competitive business enterprises, however large or prosperous they may be,

on the one hand, and monopolies on the other. We have before called attention to these differences and earnestly believe that there is great need for an awakening of public sentiment with regard to them; not only among workingmen and poor people, but among employers and those who, tho perhaps rich, are engaged in perfectly legitimate, competitive business and manufacturing enterprises; make their money by giving honest values for it—values created by their own hard work and enterprise.

Has anyone heard of such doings as Lawson describes by men seeking to control or manipulate the stocks of corporations engaged in competitive lines of business—in department stores, in machinery building establishments, or anything of that kind? We think not. That fact is significant and is worth thinking over a little. Lawson's revelations are making many people nervous under the belief that he is attacking wealth and the holders of it, and that his articles are calculated to depreciate the values of "property." Such an effect, of these and of all similar attacks, can be largely provided against if the business men and manufacturers of the country will insist that it is wrong to "bunch" all large and successful enterprises and fight them all as vicious, or to defend them all together as good without discrimination and without regard to their real character. We insist upon it that it is the character of the business done by a commercial organization which determines whether it be beneficial or the reverse; not its size, the wealth of its owners, nor the question of whether they paid too much or too little for it. No Lawson will ever accuse machinery builders of such doings in courts of law and elsewhere as are described by him as being done by Addicks, himself and others in connection with Bay State Gas control, for the simple reason that the building of machinery is not a monopoly, but is a business which anyone who has or can command the capital and brains can go into freely and on equal terms.

History of the A. S. M. E.

We have before referred to the fact that a history of the American Society of Mechanical Engineers is being prepared to be published on the twenty-fifth anniversary of the founding of the society; the incentive to the work of doing this having been found in the difficulty experienced by one of the members of the society in tracing the histories of various technical societies of Great Britain.

The work has been undertaken in a very thorough manner by the committee referred to, and it is believed that the publication of it, when complete, will be of very great value and interest. It has been thought that perhaps some readers of the AMERICAN MACHINIST may find it possible to help this committee. If there is any reader who can himself supply data or material, or who may know of anyone who can do so, he may confer a favor upon the committee and upon the society. In this connection we are asked to print a communication from Mr. H. H. Suplee, secretary of the committee referred to, as follows:

Twenty-five years ago a small party of engineers met in the office of the AMERICAN MACHINIST, then in a building still standing on the corner of Fulton and William streets, in New York city, and took the preliminary steps toward the formation of an engineering organization, which body became the American Society of Mechanical Engineers. It has been decided to prepare, in commemoration of this anniversary, a history of the origin and development of the society, and this work, which has been placed in the hands of a special committee, is already well under way. In order that the records of the beginnings of this important professional association may be made as complete as possible, it is especially desired that any of those who attended that early meeting, held on February 16, 1880, or who have been in any way interested in that early work, may send to the committee any memoranda, correspondence or other matter of interest relating to that gathering or to the events which immediately followed.

The committee has already been favored with much efficient help from various members of the society in connection with its work, and as the preliminary work must now soon be brought to a close, it is hoped that this communication may bring additional material for its use.

Communications may be addressed to the Historical Committee, American Society of Mechanical Engineers, 12 West Thirty-first street, New York.

The Department Store Tax and German Manufacturers.

According to a report sent here by our consul at Chemnitz, J. F. Monaghan, the special tax which was some time ago levied upon department stores in Germany has proved a failure so far as the attainment of its objects is concerned, and has turned out to be an additional burden laid upon the shoulders of the German manufacturer who naturally thinks he had enough burdens to carry before. In practise it has been found that the tax levied upon these stores is very readily shifted. It is not explained just how the tax was shifted to the manufacturers, but we suppose the necessity of paying the tax was used as a lever to force down the manufacturers' prices, tho of course their prices could not have been forced down if they had already been as low as possible and they might owing to dull times and other causes have been just as much reduced without the tax and by the operation of the forces that are always at work to reduce the prices of manufacturers. Ordinarily during a depression in business such as is occurring in Germany now prices go down—not only manufacturers' prices, but the prices at which goods are supplied to the customers as well. Now, it may easily happen that when a special tax is imposed, such as the one under consideration, the competition between manufacturers goes on just the same and their prices go down, but the tax, by adding to the cost of the goods delivered to the merchants' shelves, keeps up the price to the consumer, and thus the manufacturer may think that he alone bears the burden of the tax, whereas, as a matter of fact, it is borne by the consumer, who, tho he does not pay an increased price, fails to secure a lower one which he would otherwise have secured. Every tax upon production or commerce adds to the cost of the goods produced and must be paid by the consumer of the goods. It is an axiom that the consumer pays all taxes and those who imagine that taxes levied upon department stores are paid by the proprietors of such stores or by the manufacturers who supply them with goods, simply deceive themselves. A special tax levied upon certain kind of stores may so increase the cost of their goods as to drive them out of the business and to that extent lessen competition. In the end the effect is the same. Department stores are nothing more than an attempt to introduce into retail trade some of the economies and improvements long since introduced into manufacturing operations. Those who contend against them are doing essentially the same thing as is done by those who oppose the introduction of labor-saving machinery.

Technical Publications.

"Untechnical Addresses on Technical Subjects." By James Douglass. 84 5x 7½-inch pages. John Wiley & Sons, New York. Price, $1.

Of these extremely interesting addresses there are three—The Characteristics and Conditions of the Technical Progress of the Nineteenth Century, The Development of American Mining and Metallurgy and The Equipment of a Training School and Wastes in Mining and Metallurgy. The leading ideas developed in the first address are the growth of the interchange of information among technical men, which the author regards as "one of the glories of the vanishing century" (the address was given in 1899) and the progress of transportation. The second address is largely a pean of praise of labor-saving machinery, and the third explains some of the striking advances that have been made in the saving of by-products and points out other equally striking wastes of such products which remain to be overcome. While strictly non-technical, the addresses manifest both a minute and extended technical knowledge.

"Notes & Formules de l'Ingénieur et du Constructeur Mechanicien—Mathématiques, Mécanique, Electricité, Chemins de Fer, Mines, Metallurgie, etc." By

a Committee of Engineers of Central Schools and of the Arts and Trades. 14th edition, revised, corrected and considerably enlarged. Pp., 1832; 4½x7 inches. Ills., 1350. Paris: E. Bernard, 29, quai des Grands-Augustins. Price 12½ francs in Paris and 13½ francs free, in the provinces and abroad.

It would be a bold undertaking to review comprehensively in eighteen lines a book of eighteen hundred and odd pages in rather fine print, such as the above. If there is any other engineering hand-book that contains as much matter, we cannot recall its name. As above indicated, the present one has many times over proved its fitness to survive by the most conclusive of tests, having now entered its fourteenth edition. A feature of the book is a French-English-German technical vocabulary at the end, which, while not copious enough to form a complete substitute for the larger lexicons of that character, will doubtless be appreciated so far as it goes, especially on account of its modernness. Another point worthy of note is the proposition of the publisher to make an allowance of 6¼ francs for earlier editions returned in exchange.

The Department of Mechanics of the University of Arizona has started an indexed catalog file, and requests catalogs of steam and gas engines, electro-dynamic, hydraulic, mining and milling machinery, fittings and supplies. They will be used for purposes of instruction, as will also a collection that is being formed of mechanical devices, machine parts, fittings and samples of supplies and materials of machine construction. Any contribution to the collection will be very welcome. Address Prof. E. M. Blake, University of Arizona, Tucson.

Some New Things.

ENGINE LATHE.

The accompanying illustrations show the new Hendey-Norton lathe with some special features which are deemed worthy of particular mention and most important of which is the new compound gear box applied to all sizes of the lathes from 12 to 20 inches swing. This gear box is attached to the end of the regular gear box at the front and contains sliding gears controlled by a lever and permitting of instantaneous compounding of the train without removing a gear; the combination of the two boxes gives thirty-six changes and covers a broad range of threading and turning feeds, approximating threads from 1½ to 80 per inch and feeds from 7½ to 400 per inch. The threads available in the range are all standard pitches. Outside of this regular list of threads, the gearing on the sector of the lathe is so arranged as to be easily changed so that any special thread or threads not found on the index may be cut with a special gear, which gear also works thru the whole thirty-six combination, often cutting other useful threads. The view of the unassembled lathe head shows the entire make-up of the head, covering the taper bearing, the spindle construction, the boxes of cylindrical form outside carried in annular housings, each of the latter having a large oil pocket in which a ring oiler for the bearing is suspended, thus furnishing constant lubrication to the bearings while in motion. As showing the advantage to be derived from ample lubrication, coupled with rigidity of bearings, it may be stated that an inspection and test made of a lathe head with this form of bearing after six years' continuous service in the shops of the builders—the Hendey Machine Company, Torrington, Conn.—showed that the bearing

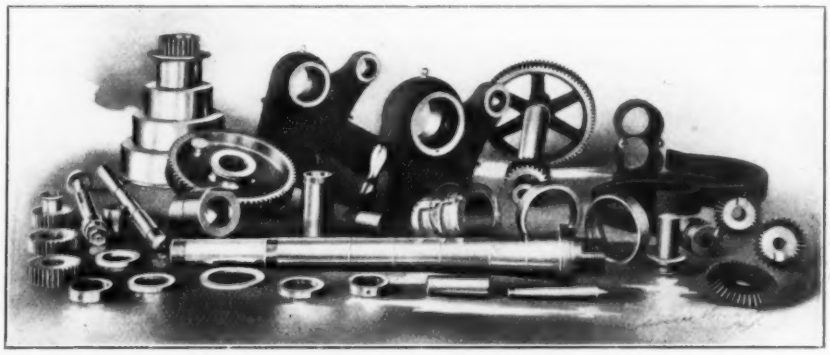


FIG. 2. LATHE HEAD PARTS.

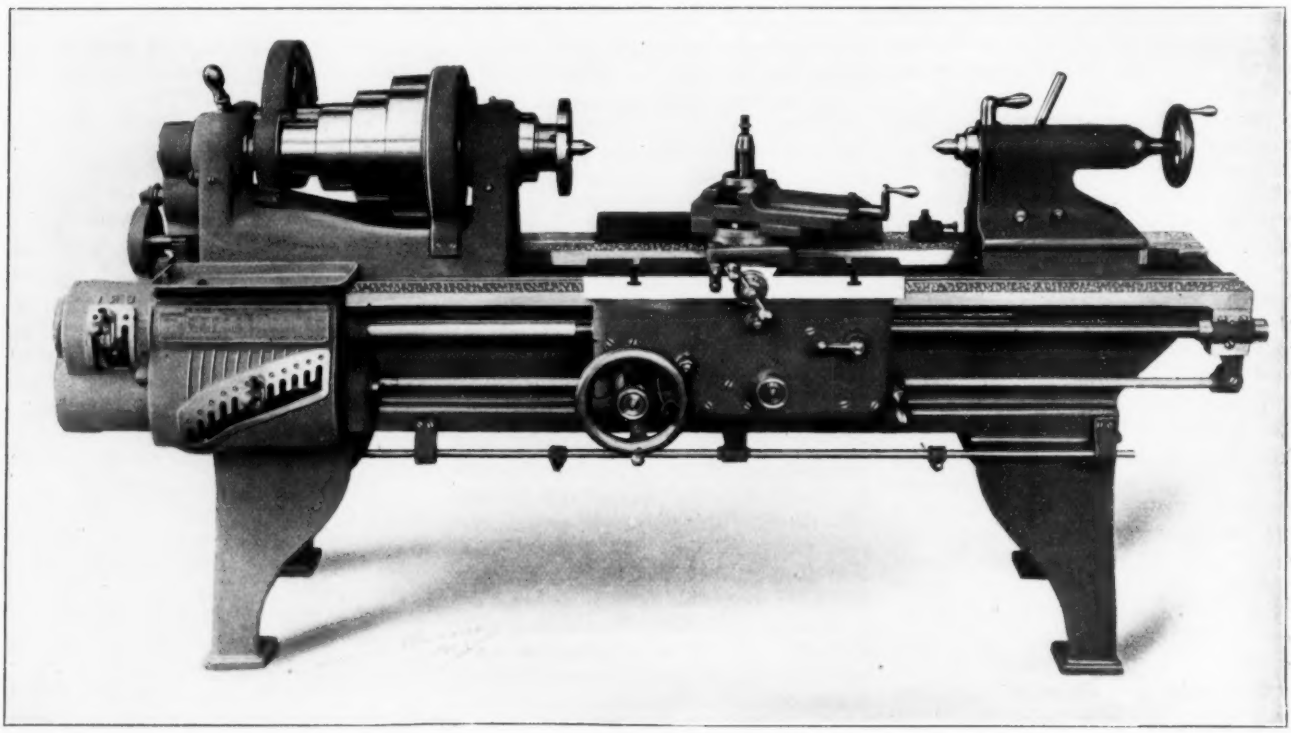
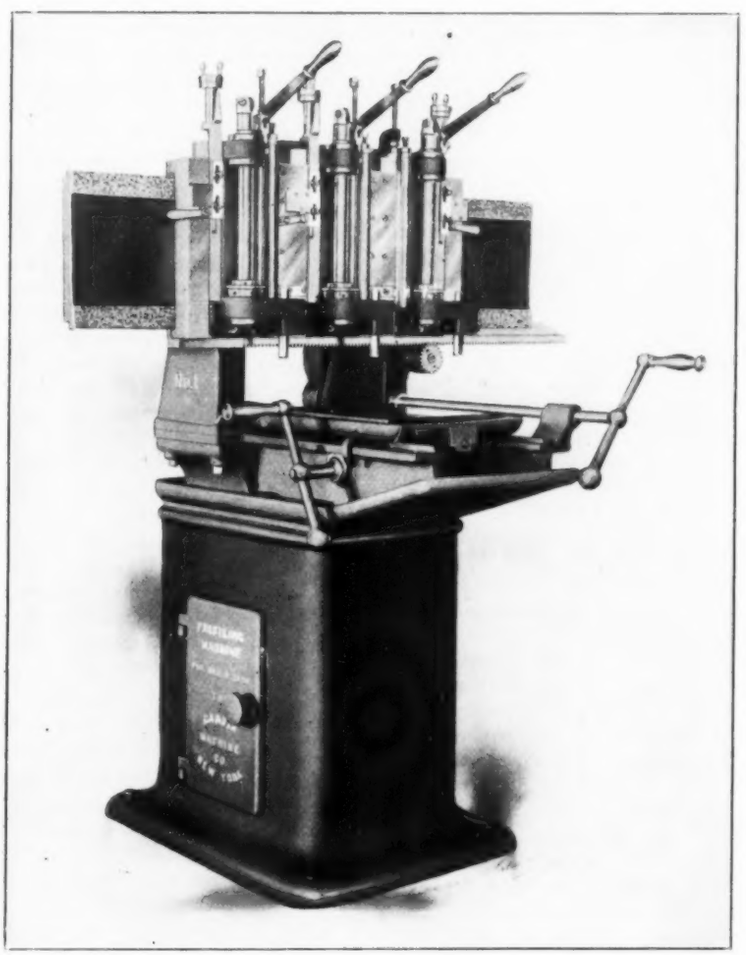


FIG. 1. 20-INCH HENDEY-NORTON LATHE.

was practically as good as when first assembled, and that the alinement of the spindle had been maintained with no perceptible change from the beginning. The lathe head is sufficiently stiff to admit of the use of a three-step cone in place of the four-step at any time it is desired to get more power in the spindle drive for high-speed steel work. It is to be noted that as these lathes run both belts from the countershaft in the cutting direction, the two countershaft speeds in connection with the three-step cones give twelve different spindle speeds. In the design of this lathe steel gearing has been added wherever necessary, the bed and other parts are made heavier than formerly, and the diameter of the spindle nose is increased for heavy chuck work.



THREE-SPINDLE PROFILER, WESSON DRIVE.

THREE-SPINDLE PROFILER.

On gun work and work of similar character, three-spindle profiling machines of the design shown are now being used. The spindle on the left is used for roughing, and then two successive finishing cuts are taken with the other two spindles; or there may be two roughing and one finishing cut. This conduces to extremely accurate results and reduces the wear on the cutters. The spindles are driven on the Wesson patent system by universal joint rods reaching down from a special countershaft above. This system of driving allows each spindle to be driven at a different speed and in either direction, so that the roughing cutter can be run slow and the finishing cutter fast, and one spindle right hand and the other left hand, which adapts the machine to the work and increases the efficiency and output. The spindles can easily be run at 2,000 revolutions by this method of driving, which is particularly adapted for the high speeds used with the new tool steels now coming into common use. This system permits a stiff and compact construction, as there are no belt or other openings in the frame and slides.

Each spindle slide is balanced by spring and fitted with adjustable micrometer lock notch stop and gage stops. The table and cross-slide are moved by large ball handles and provided with split gearing to take up all back lash. Oil channels are arranged all around the bed and table, and a reservoir is formed in the base for lubricant, to which pump and piping can be fitted when desired. The machine is built by the Garvin Machine Company, of New York.

An arc-light wire touched a cupola and a molder taking iron was severely shocked at Ottawa, Ill.

Japanese Patent and Trade-mark Laws.

BY E. P. BUFFET.

That ineffable conceit and arrogance which the European races in general, and the Teutonic in particular, have always shown toward Asiatic peoples is exemplified by attacks upon the commercial honesty of the Japanese. Two particulars having been discovered in which, it was believed, their commercial standards compared somewhat unfavorably with ours—defective credits and trade-mark imitation—these lonely strings have been twanged upon to the point of wearing out, quite in forgetfulness of the thousand and one forms of Occidental business iniquity which probably are unimagined by the Oriental mind. Since the outbreak of the war, the example of fidelity in military service and supply by which Japan has put to shame, not only the Land of Embalmed Beef, but every other country on the globe, has been an object-lesson which no comment can intensify.

In respect to trade-mark and patent protection, it appears that Japan has only lately acquired that experience in the conventional methods of Western nations required to put her in a position where she may justly be judged by our standards. She has recently promulgated a system of modern patent legislation and has hardly yet had opportunity to educate her people up to conformity with it. But the manner in which the task has been undertaken, coupled with her famous success along new lines of enterprise generally, augurs that it will be carried out with fidelity and success.

The following account of the development of this legislation is derived from *Glasers Annalen fuer Gewerbe und Bauwesen:*

The laws to-day in force in Japan for the protection of business property bear numbers 36, 37 and 38 of March 2, 1899, and cover inventions, industrial designs and models, factory- and trade-marks. They embody a revision of earlier laws of December 18, 1888, and are made on the ground of subsequent experience in patent affairs, with reference to the industrial development, as well as to the national trade of Japan, after revision of the commercial treaties, and after the entrance of Japan into the International Union for the Protection of Business Property.

The current patent law guarantees fully and effectively the protection of industrial properties to natives and foreigners, without respect of persons, and allows manufacturers to have suitable registration made of their rights. Very considerable penalties threaten those who disregard patents on inventions, or directly copy them, or who imitate the recorded designs and trade-marks. Finally, the Japanese patent law guarantees, before or after the date of issuance of the patent, or the registration, all rights to the invention. Altho this law was first applied to the use of foreign patent applicants after the re-

vised commercial treaties with Japan were ratified and exchanged—with Germany, for example, in November 1896—yet it was already, in its various provisions, fashioned entirely according to foreign laws. Since the new patent law has gone into force, the rights of inventors are equally protected, whether Japanese or foreigners.

According to the official publications of the Japanese Minister of Finance, on which these statements are based, the number of patents applied for and awarded, and design copyrights and trade-mark registrations shows the following development:

Year.	Patents on Inventions.		Design Copyrights.		Registration of Trade-marks.	
	Applied for.	Granted.	Applied for.	Granted.	Applied for.	Granted.
1887	906	109	. .	. .	757	361
1888	778	183	. .	. .	568	436
1889	1064	209	176	23	1029	664
1890	1180	240	497	82	819	583
1891	1288	367	290	117	898	554
1892	1344	379	262	48	1146	588
1893	1337	318	251	59	1243	648
1894	1250	326	336	64	1350	877
1895	1122	223	318	94	1373	923
1896	1213	169	300	96	1578	858
1897	1542	188	320	90	3228	2335
1898	1789	293	265	52	2232	1597
1899	1915	597	342	139	2837	1942
1900	2007	586	397	130	2776	1767
1901	2397	606	514	141	2608	1620
1902	3095	871	930	252	3529	1883

Comparison of the percentage relation between the applications and allowances under the operation of the older and newer laws shows that for patents on inventions, in the year 1887, 12 per cent.; in 1895, 20 per cent.; in 1902, 25 per cent. of the applications were successful. For design copyrights, the ratio in 1889 was 13 per cent.; in 1895, 30 per cent.; in 1902, 27 per cent. Among registrations of trade- and factory-marks, in 1887, 48 per cent.; in 1895, 69 per cent.; in 1902, 53 per cent. were granted. It follows therefore that, since the new law went into effect, only the percentage of allowed patents on inventions proper has increased, while the proportion of designs and trade-marks favorably considered has gone backward since 1895. In the procedure for the award of patents, etc., the applications are first tested by a preliminary examiner after whose unfavorable opinion there is allowed a new examination, and an appeal to the Patent Office, and it appears that finally a review by the highest court of justice is possible. Every person who wishes to put in an application or claim in patent affairs, or is holder of a Japanese patent, must, in case he himself is not domiciled in Japan, appoint as representative a resident of that empire.

If the holder of the patent does not bring his invention into public use in Japan within three years after the issuance, or generally speaking, if for three years he has not striven in that direction and without visible reason refuses or neglects to assign or lease it to third parties altho they offer acceptable terms, the chief of the Patent Office can recall the patent. Whoever wishes to act as a patent attorney in Japan must be properly authorized and come under the control of the Office.

The first Japanese law for the protection of industrial property, of April 7, 1871, was highly summary in character, related only to direct inventions, and for the first time insured to the inventor the undisturbed enjoyment of his intellectual production. This law was in March, 1872, modified by a simple order that every inventor must furnish information to his departmental authority, who had then to write a report to the Minister of Public Works. The want of legal provisions brought the inventor, however, into a critical situation, and since there was little or no legal protection of trade-marks, those trades people and manufacturers who, in consequence of the good quality of their wares, enjoyed public confidence became very easily the prey of fraudulent competitors, and the number of inferior products and imitations ever increased. These circumstances impelled the Minister of Finance to work out a project for the protection of factory- and trade-marks, which subsequently convinced the Ministry of Agriculture and Trade and was perfected and applied. This project for the protection of trade-marks became a law in June, 1884; the law for the protection of inventions followed in April, 1885.

These two laws were still by no means perfect, and their practical application presented many difficulties. Moreover, there was still needed a law to protect the designer of patterns or models, since these products were inconsiderately copied, very much to the detriment of Japanese industrial development. To obviate this disadvantage a design-protecting law had to be issued. A compilation of all laws relating to industrial property, published December 18, 1888, dealt with inventions, trade- and factory-marks and registered designs. These three laws determine, moreover, the procedure which is to be observed in filing the patent application, in its testing and allowance, and mark an important step forward in Japanese legislation.

Article 17 of the revised commercial treaty between Japan and England, published in 1894, secures the reciprocal protection of inventions and trade- and factory-marks. Further, Article 3 of the final protocol of the Imperial Japanese Government pledges itself to enter the International Union for the Protection of Industrial Property. With the other powers Japan has generally entered reciprocal protective relations similar to those with England. The provisions of the treaties between Germany and Japan were published in November, 1896, and contain paragraphs about the protection of inventions, factory- and trade-marks, drawings and designs.

From July 15, 1899, Japan has come into the International Union for the Protection of Industrial Property. Within a space of somewhat more than ten years, therefore, Japan has entirely discarded its old laws on inventions and replaced them by modern and generally received principles, which are very favorable to the development of its domestic industry.

According to the official compilation of the Finance Minister, the Japanese Patent Office, November, 1896, to December, 1902, has received the following applications from abroad:

Invention—patents applied for	1,435
Invention—patents granted	691
Design copyrights applied for	20
Design copyrights granted	11
Factory-marks—registrations applied for	3,507
Factory-marks—registrations granted	2,686

A New Steel Concern.

A move likely to be of considerable importance in the steel trade is being taken in Pittsburg by Reuben Miller, Jr., who was prominently identified with the Crescent Steel Company which was absorbed by the Crucible Steel Company of America and is now a part of the United States Steel Corporation. Mr. Miller has organized the Crescent Steel Forging Company and will be its head, with D. W. Dunlevy as vice-president and general manager. The stock of the new company has been subscribed and it is intended to make steel forgings of all kinds of the highest grades, such, for instance, as are required for milling-cutters, dies and other tools where the best possible results are sought.

Temporary American Car Shops in England.

The American Car & Foundry Company, thru J. R. Searles, its representative, recently obtained, after competing with British car builders, a large contract to supply the cars for the Baker Street & Waterloo Underground Railway in London. It was necessary to cut corners quite severely in order to secure the contract under these conditions and the matter of cost therefore became a first consideration with the car company. The "impressive" importance of the incident is that the American Car & Foundry Company immediately after closing the contract acquired on November 29 a site on which to erect large car works—which will be more or less temporary in character, their permanency to depend on receiving additional contracts—and that the new shops will be erected and equipment installed and first delivery of finished cars will be made early in March.

The only portion of the work that will be sent from this country will be the iron and steel work, which will be exported in finished form. The remainder of the work will be done in England and will neces-

sitate the employment of local labor on the current contract of between $75,000 and $100,000. The new works are to be erected in Trafford Park, Manchester, and available to the cheaper transportation of the Manchester Ship Canal.—*Journal of Commerce* (N. Y.).

Personal.

Charles L. Parmele, formerly with the J. W. Cregar agency, of Philadelphia, is now connected with the Vandyck Churchill Company, 8 Dey street, New York, as a machine tool salesman, working from the Philadelphia store.

O. E. McMeans and Chas. A. Tripp have opened an office as consulting engineers at 931 State Life Building, Indianapolis. Mr. McMeans had been for three years chief draftsman for the Nordyke & Marmon Company, of Indianapolis, and Mr. Tripp was for some eight years chief engineer for the Bemis Bag Company.

Walter S. Timmis, inventor of the Lithotype, which was shown at pages 242 and 309, has opened an office as consulting engineer at 150 Nassau street, New York. He makes a specialty of buildings, plant and equipment for printers and manufacturers of paper products, including special machines for the exclusive use of clients and humidity and temperature control.

W. C. Redfield will on January 1 next become president of J. H. Williams & Co. (drop forgings), Brooklyn, and will take charge of the business in place of J. H. Williams, whose sudden death we recently noted. Mr. Redfield is thoroughly familiar with every detail of the business, having been associated with Mr. Williams from its establishment in Brooklyn in 1884 until in 1901 he became Commissioner of Public Works in Brooklyn under Mayor Low.

Obituary.

Sir Lowthian Bell, the eminent British ironmaster and metallurgist, died December 19, seventy-eight years old. He had contributed largely to the industrial development of the latter half of the last century. He was mainly instrumental in changing blast furnace practise from the crude methods which prevailed prior to 1850 until the modern stack has become the most economical method of reducing ore ever known. The connection of Sir Lowthian with steel manufacture was, rather curiously, never prominent, but he distinctly cleared the way or largely opened the opportunity for Siemens and Bessemer. He had been president of the Iron and Steel Institute of Great Britain, was a former mayor of Newcastle, and for some years a Member of Parliament.

Business Items.

The Cleveland Pneumatic Tool Company has sent us a very attractive calendar for the new year.

Business is improving very rapidly with the Colburn Machine Tool Company, Franklin, Pa., builder of vertical boring and turning mills, and the prospects are bright for all the business it can take care of in the near future.

The Northern Electrical Manufacturing Company, Madison, Wis., recently received an order for three 150-kilowatt, slow-speed generators from the Tennessee Coal, Iron & Railroad Company, of Birmingham, Ala. The order was received thru J. B. McClary & Co., representing the Northern Electrical Manufacturing Company at Birmingham.

E. F. Houghton & Co., of Philadelphia, Chicago and Detroit, have issued a new catalog illustrating the various methods of installing the Marck steam trap, which they will mail free of charge to anyone writing to their Philadelphia address, 240 West Somerset street. It is interesting reading to anyone interested in the economical use of steam, the prevention of steam pipes freezing or the obtaining of a uniform heat at a minimum pressure.

Manufacturers.

Douglas, Ga., proposes to build an electric lighting plant.

The Ideal Hoop Company, Ashtabula, O., has bought a site for another plant.

The Ford Flour Company, Nashville, Tenn., will build a new factory in the spring.

A mill of the Greenville (Me.) Manufacturing & Veneer Company has been burned.

The Board of Trade, Cadillac, Mich., is in touch with a table factory which may locate there.

The Hedrick, Ia., Business Men's Association is fostering a corn canning factory project.

The Liquid Carbonic Company, Chicago, Ill., proposes to start a plant in New Orleans, La.

Plans are under way for doubling the capacity of the Susquehanna Silk Mills at Marion, O.

The Indian Asphalt Company, of Chicago, Ill., will probably establish a refinery near Lexington, Ky.

A box factory will be established at McKenzie, Tenn., by Mr. Nantz, of the firm Edgar & Nantz.

It is reported that a cotton compress will be built at Austin, Tex., by the Capital City Compress Company.

The Chas. Abresch Company, wagons, Milwaukee, Wis., will build a plant addition during the coming year.

The Goodell Tool Company, Shelburne Falls, Mass., is making repairs and alterations in its new factory.

The Mobile, Jackson & Kansas City Railroad Company is grading to build shops at or near New Albany, Miss.

The foundry and machine shop of Alpha W. Annis, near Cherry Creek, N. Y., have been burned. He will rebuild.

The Casco Bay line, which has an electric lighting plant on Peak's Island, at or near Portland, Me., is to build a new station.

Plans have been prepared for a new building to be erected by the United States Fastener Company, in South Boston, Mass.

The controlling interest in the Ordway Manufacturing Company, chairs, Bristol, Va., has changed and the plant will be enlarged.

The Weyerhauser Lumber Company interests, Tacoma, Wash., are reported to be looking for a sawmill site in or near Portland, Ore.

Robt. Caruthers, of Lowell, Mass., is having figuring done for a textile machinery factory in that city, to be 95x98 feet, three stories.

The Hammond Lumber Corporation, San Francisco, Cal., will, it is reported, establish a large lumber yard, planing mill, etc., at Los Angeles.

The Wm. H. Rogers Silver Corporation, plated ware, etc., Plainfield, N. J., expects to erect a new building in the spring, about 40x120 feet.

The Avondale (Ala.) Stove & Foundry Company has passed into new control, and the capacity of the plant will be enlarged before long.

The plant of the Winslow Voting Machine Company may be located in Marion, O., where the Commercial Club is in touch with the matter.

Application has been made on behalf of the Fearless Dishwasher Company, Rochester, N. Y., for permission to erect a 60x104-foot factory building.

Dexter Richards & Sons Company, Newport, N. H., manufacturer of flannels, etc., has under consideration the erection of a new woolen mill.

The Moloney-Bennett Belting Company is understood to have leased a five-story, 80x180-foot building at Chicago, Ill., for manufacturing purposes.

The Oregon Railway & Navigation Company has awarded a contract for the construction of new shops in Albina, a part or suburb of Portland.

The Erie City Iron Works, manufacturer of engines and boilers, Erie, Pa., is adding to its plant at least one building between 600 and 700 feet long.

The National Refining Company, Cleveland, O., has purchased the property of the Canfield Oil Company, at Findlay, and extensive improvements are to be made.

Fire has burned the plant of the Passumpsic (Vt.) Fibre Leather Company and the flour and grain mill at Passumpsic of E. T. & H. K. Ide, of St. Johnsbury.

A block at Bristol, Conn., largely occupied by the plant of the Turner Heater Company, manufacturer of hot air furnaces, is understood to have been damaged by fire.

The old plant of the Lewis Foundry & Machine Company, on the South Side, Pittsburg, Pa., has been sold to De Noon Bros., who expect to turn it into a big paint factory.

The Continental Can Company is reported to have finally decided to locate a plant at Syracuse, N. Y., to be running by February 1. The machinery is already purchased.

It seems practically assured that the Robb-Mumford Company, of Amherst, N. S., will locate a branch boiler works at South Framingham, Mass. The main building is to be 300x150 feet.

Jas. McKinney & Son, architectural iron works and foundry, Albany, N. Y., have just put in some new machinery, including electric drive, and propose to build an addition in the spring.

The New York Vacuum Cleaning Company proposes to build a plant at Plainfield, N. J., to make machinery for the cleaning process. David T. Kenney, of that place, the principal stockholder, has purchased a site.

The Ashland (Wis.) Advancement Association is considering a project for a furniture factory to be managed by a Mr. Jones from Burlington, Ia., and for a flour mill, in which a Minneapolis, Minn., man named Parker is interested.

An explosion of a 300 horse-power boiler in Brower & Love Bros. Company's cotton mills, at Indianapolis, Ind., seriously scalded three men, blew down the walls of the boiler

and storage houses and crushed in the front of a residence a block away.

Manchester, Conn., still has hope of securing the plant of the Trimont Manufacturing Company, pipe tools, Roxbury, Mass. We understood that several months ago the company was arranging to equip a plant in New Jersey, and are not sure what has finally become of that plan.

An effort is being made at Bath, Steuben County, N. Y., to form a stock company and secure the removal to that place of the factory of Charles Kirkham, of Pleasant Valley, Rhems or Taggart, near Hammondsport. The Kirkham motor is being used in automobiles and flying machines.

The F. G. Johnson Company is starting in business at 174 Pearl street, Hartford, Conn., to make check punches, time locks, electrical parts, small tools, etc. The plants of the Automatic Check Punch Company, Brooklyn, N. Y., and the Guardant Time Lock Company, of New York, are being consolidated with it.

Samuel Morris, former superintendent of the Newark (O.) Iron & Steel Company, and who is the patentee on automatic railway couplers, is quoted as announcing that a plant is soon to be erected just west of Newark for manufacturing them and other steel products. Major Moses H. Niel, of Columbus, is associated with him.

The Seamless Steel Bathtub Company has been formed at Detroit, Mich. It will draw bath tubs from a single cold sheet. It holds patents on the bath tubs and other plumbing supplies and on a rocker roller press invented by Chas. F. Murdock. The plant will be about 200x400 feet. Eugene H. Sloman is a prominent stockholder.

The plant of the Blanchard Machine Company, Boston, Mass., builder of all kinds of special machinery and contract work, was entirely destroyed by fire on the night of November 11. The company has taken a temporary place and fitted it up with a few machines, but is building a large new plant, which will be ready for occupany in a couple of months, and is in the market for a large equipment of machine tools.

The two plants of the American Clay Working Machinery Company, one located in Willoughby, O., and the other at Bucyrus, have been sold at receiver's sale to the bankers' reorganization committee, representing the creditors, for $350,000. The plants will be operated by a new company, to be known as the American Clay Machinery Company, within a few weeks, and there will be no change of management. The new concern is capitalized at $500,000.

A broom factory maintained by labor organizations of Montana will be established in Helena within the next few months, if plans are carried out. It will be known as the Co-operative Broom Manufacturing Company, and a commission has been issued by the Secretary of State authorizing J. A. Ferguson and several prominent labor leaders to proceed with the organization of the company. Among them are the president and secretary of the Montana Federation of Labor.

New Catalogs.

F. E. Wells & Son Company, Greenfield, Mass. The "Wells" pipe threading machine. Illustrated folder.

Colburn Machine Tool Company, Franklin, Pa. Pamphlet descriptive of the 53-inch vertical boring and turning mill built by this company. Illustrated.

Evans Friction Cone Company, Newton Center, Mass. Catalog of various patterns of Evans friction cones, illustrated, with a partial list of users. 4½x8, pp. 30, paper.

Moline Tool Company, Moline, Ill. Catalog No. 1, showing the line of gang drills, gang borers, speed lathes, bolt cutters, etc., built by this company. 6x9, pp. 15, paper.

Jeffrey Manufacturing Company, Columbus, Ohio. Pulverizing and crushing machinery for various materials and purposes, accessories and parts. Illustrated. 6x9, pp. 51, paper.

Cincinnati Screw & Tap Company, Cincinnati, Ohio. Catalog No. 12, with illustrations and lists of sizes of set screws, cap screws, studs, bolts, taps, reamers, screws, drills, nuts, etc. 6x9, pp. 32, cloth.

The Ridgway Dynamo & Engine Company, Ridgway, Pa. Bulletin No. 14, describing the construction of the Thompson-Ryan dynamo, with illustrations of different sizes of generators. 8x10½, pp. 8, paper.

The L. S. Starrett Company, Athol, Mass. Supplement to Catalog No. 17, showing some additional Starrett tools, including new micrometers, micrometer cases, protractors, jewelers' screw-drivers, etc. Illustrated. 5¼x7½, pp. 16, paper.

Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. Folder No. 4,030, descriptive of Westinghouse type "S" motors for direct-current circuits and showing a number of adaptations to machine tool drive. 3½x6, pp. 12, paper.

Morse, Williams & Co., Philadelphia, Pa. Hindley worm gearing and Hindley spirals, with tables of pitches and dimensions, sectional drawings and illustrations of applications. This catalog will doubtless be of interest to all who have to do with worm gearing and worm gear applications. 6x9, pp. 92, paper.

I. P. Morris Company, Philadelphia, Pa. Turbines and centrifugal pumps. Bulletin No. 1, containing views of water power plants at Niagara Falls, Trenton Falls, N. Y., and other places where I. P. Morris turbine machinery has been installed. Views are also shown of heavy centrifugal pumping machinery supplied by this company for the pumping stations of the New Orleans Drainage Commission. 8½x10½, pp. 51, paper.

The Ingersoll-Sergeant Drill Company, New York, and 114 Queen Victoria street, London, E. C., England. Catalog No. 44, illustrating and describing fully the rock drills, mining, tunneling and quarrying machinery built by this company. This catalog is specially prepared for distribution in England, the prices being all in English currency, and copies will doubtless be sought after by those in the British Isles who are interested in this class of machinery. 6x9, pp. 165, paper.

Clayton Air Compressor Works, 114-118 Liberty street, New York. Bulletin No. C201, showing twenty-one types of air compressors, including single and duplex machines, steam driven, power driven and electrically driven by gear, chain and belt. There are shown, also, air compressors driven by direct-connected oil engines, making convenient units for installations where small plants are desired. The range of sizes includes machines displacing from 2 cubic feet of free air per minute to those having a capacity of 1,400 cubic feet. 6x9, pp. 48, paper.

Henry R. Worthington, 114 Liberty street, New York. "Pumping Machinery." This is a handsome catalog of 130 pages showing Worthington pumps for a large variety of services, including standard pattern steam pumps, boiler feed pumps, compound pumps and pumping engines, water-works pumping engines, etc.; also surface condensers, air and circulating pumps, condensers, cooling towers, centrifugal pumps, water meters, etc. The catalog is printed on coated paper and is illustrated throughout by full-page half-tone cuts. 6x9, pp. 130, paper.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks., Waltham, Mass.

Addressing machines for office use. Joline & Co., 123 Liberty St., New York.

Designer of tool and automatic machinery. Fred Mill, East View, Cincinnati, O.

Mark your tools; a 3-initial stamp, 50 cts., post paid. J. L. Lucas, Bridgeport, Conn.

Light mach'y to order; model work; rubber molds. J. W. Weir, Bridgeport, Conn.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Automatic machinery designed and constructed by the Wellman Sole Cutting Machine Co., Medford, Mass.

Patented improvement on machine tool for sale or manufacture on royalty. Address C. J. Dailey, So. Bethlehem, Pa.

Auto. machinery of all kinds designed and built; hardened and ground work, flat or circular. Wiebking, Hardinge & Co., Chicago.

The Canada Machinery Company, Limited, Sarnia, Canada, have the facilities and are open to manufacture, for patentees and others, machines and machinery for the Canadian market.

Large machine shop and foundry, well equipped for light and heavy work, wishes to manufacture one or more staple articles in addition to present line; will not undertake the sale, but will manufacture on percentage or at a fixed price. Box 55, AMER. MACH.

Le Progres Industriel, Ltd., 14 Rue des Croisades, Brussels (Belgium), having decided to erect new works for their machine tool manufacture and to considerably increase their plant, would like to receive from American machine tool manufacturers, etc., their catalogs concerning machine tools, working implements, special devices, materials, etc., that might prove of interest for above company before purchasing their new machines and plant.

The annual meeting of the stockholders of the Derry-Collard Company, for the election of directors for the ensuing year and for the transaction of such other business as may properly come before the meeting, will be held at the company's office, Nos. 256-7 Broadway, Borough of Manhattan, City of New York, N. Y., on Tuesday, January 10, 1905, at six o'clock in the afternoon. Dated New York, December 22, 1904.

ALBERT W. POLLARD, Secretary.

The annual meeting of the stockholders of the Hill Publishing Company, for the election of five directors for the ensuing year and for the transaction of such other business as may properly come before the meeting, will be held at the office of the company, in the Pulitzer Building, 63 Park Row, Borough of Manhattan, New York City, N. Y., on Monday, January 9, 1905, at 12 o'clock noon. Dated, New York city, December 5, 1904.

F. R. LOW, Secretary.

Business Opportunities.

A successful, growing, Cincinnati concern, manufacturing patented machine tools for past ten years, feels the need of an up-to-date, hustling business manager, willing to invest at least $10,000. Address Box 62, A. M.

A Great Opportunity for a Practical Foundry Man or Machinist.—To Rent or For Sale—A first-class foundry and machine shop in a large manufacturing town in Ontario; the plant is new and complete in every detail; owner has other interests which demand his whole attention. For particulars address A. B., care AMERICAN MACHINIST.

For Sale.

For Sale—A going machine shop with large possibilities; been running many years; cause of sale, death in firm. W. D. Judson, New Haven, Conn.

For Sale—Two 100 H.-P. return tubular boilers; good for 100 lbs. working pressure, "Hartford inspection." Apply C. E. Johnson & Co., 509 So. 10th st., Philadelphia; or T. Frank Miller, Architect, Philadelphia.

I can sell your machine shop (or other business), with or without real estate, no matter where it is or what it is worth. Send description, state price and learn how. W. M. Ostrander, 111 North American Bldg., Philadelphia.

For Sale—United States patent No. 719,854, 1903, for best water gage in the world;

now giving splendid results on English market; see description on page 788, December issue of POWER. Apply James Robinson, G. P. O. Leeds, England.

For Sale—10 in. lathe patterns, drawings, jigs, templets, special tools and everything else necessary to manufacture the best 10 in. engine lathe on the market; no experiment; easy terms. Address The R. K. Le Blond Machine Tool Co., Cincinnati, O.

For Sale—State rights to manufacture a machine that is in demand in all sections of the country; will furnish tools, jigs and all special machinery necessary to manufacture machine; an excellent opportunity for machine shops in small cities; no experiment; the machines have been in general use for over three years; reason for selling, territory too large for present builders to handle. Address W., care AMERICAN MACHINIST.

For Sale—Four Watts-Campbell Corliss engines, 24x56; 400 horse-power at 100 lbs. steam pressure; 70 revolutions per minute; flywheel—diameter 20 ft., face 46 in.; condition first class. One double Watts-Campbell Corliss engine, 18x42; 250 horse-power at same pressure; 91 revolutions per minute; flywheel—diameter 16 ft., face 32 in. One N. Y. Safety engine, 12x12; 75 horse-power at same pressure; 250 revolutions per minute, 2 belt wheels, 4½ ft.; diameter 17½ in. and 13 in. face. Will sell singly. Can be seen in New York city by addressing The United Electric Light & Power Company, 1170 Broadway, New York city.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona-fide situation want or help want advertisements inserted under this heading. Agency advertisements must be placed under Miscellaneous Wants.

Situations Wanted.

Classification indicates present address of advertiser, nothing else.

CONNECTICUT.

Designer-draftsman of automatic machinery, tools fixtures, jigs and dies, open for engagement from January 1; technical and practical experience. "Immediate," care A. M.

ILLINOIS.

Broadly qualified machine works general superintendent, desiring new location, invites confidential inquiries; state particulars. "Conservant," care AMERICAN MACHINIST.

MASSACHUSETTS.

Position by experienced iron foundry foreman; engine, machinery building; first-class references. Box 93, AMERICAN MACHINIST.

Position wanted by a mechanic in machine shop; jigs, tools, die maker or foreman for light machinery and hardware; harden and temper in quantities; is a hustler; gives up position January 1, 1905, as superintendent of a manufacturing concern for 15 years. Address P., care AMERICAN MACHINIST.

MICHIGAN.

Superintendent wants to change; is O. K. Address Box 90, AMERICAN MACHINIST.

Designer, graduate M. E., age 29, 2 years shop, 8 years office, as designer, inspector, engineer on apparatus, electro-mechanical, special machinery, absolutely first-class, desires good opening. Box 122, AMER. MACH.

NEW JERSEY.

Competent foreman, machinist and toolmaker, experienced in duplicating mechanical appliances in general. Box 118, AM. M.

NEW YORK.

Blueprinter, long experience, wishes position. Box 132, AMERICAN MACHINIST.

Mechanical designer, 16 years' shop and drafting experience, wants position. Box 131, AMERICAN MACHINIST.

Mechanical draftsman, 8 years' shop and drafting-room experience, wishes position. Box 130, AMERICAN MACHINIST.

Young mechanical draftsman, 2½ years' drafting experience, would like position in engineer's or drafting office. Box 128, A. M.

First-class draftsman and designer on heavy machinery open for engagement; gas engines preferred; best references. Box 103, AMERICAN MACHINIST.

Mechanical engineer desires position as chief draftsman with engine builders; N. Y. or New England States preferred. Box 113, AMERICAN MACHINIST.

Wanted—Position as foreman with reliable concern; varied experience; can handle help profitably and is a thorough mechanic. Box 4, AMERICAN MACHINIST.

Position wanted by A1 machinist of unusual experience in jobbing shop or factory; New York preferred; salary $20 to $25 per week. Address Box 129, AMER. MACHINIST.

Wanted—Position as traveling salesman for the introduction of machine tools; well acquainted with most of the machine shops and dealers in U. S. and Canada. Address "V.," care AMERICAN MACHINIST.

Help Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Wanted—First-class polishers on gun work. Ross Rifle Co., Quebec, Canada.

Wanted—First-class toolmakers for fixtures and gauge work; applicants should state details of experience and wages wanted. Ross Rifle Co., Quebec, Canada.

CONNECTICUT.

Wanted—Experienced draftsman on gas engines. Mianus Motor Works, Mianus, Ct.

ILLINOIS.

Wanted—A first-class mechanic with experience in building wood-working machinery, for foreman of vise and floor work. Address Box 82, AMERICAN MACHINIST.

Wanted—Chief draftsman in drafting room employing from 5 to 12 men; must be accurate, capable of securing careful and rapid work from the men under him; experience in transmission machinery and in lighter structural work, together with familiarity with sheet metal work, is desirable. Address, with full particulars, Box 127, AMER. MACHINIST.

Wanted—Foreman machinist to take charge of a manufacturing department, employing about 60 hands, in one of the best cities in the Middle States; an educated man preferred; must be a good mechanic and have had experience in manufacturing special light work, such as sewing machines, gun work, or other similar product, where the most modern, up-to-date machinery, tools and methods were employed; must be a man of good character, capable of handling men and of producing good results; a permanent position for the right man; write full particulars in regard to age, experience, salary, etc. Address Box 112, AMERICAN MACHINIST.

INDIANA.

Wanted—First-class operators for large milling machines, also lathe and boring mill operators; good jobs for good men. Apply or write, Atlas Engine Works, Indianapolis, Ind.

MASSACHUSETTS.

Wanted—First-class machine designer; $100 per month; position in Connecticut. Address Drawer "K," Holyoke, Mass.

Wanted—Foreman for machine shop employing 100 men on printing presses; state age, education, experience and give reference. Address Box 119, AMER. MACHINIST.

MICHIGAN.

Wanted—Factory superintendent; an experienced man in an extensive manufacturing plant in a desirable city in one of the middle States; must be accustomed to the latest and best machine shop methods and practices; a technical graduate preferred, provided he has had actual shop experience; to suit us he must be a broad-gauge man of character and ability; must know how to get results, and be capable of producing accurate, interchangeable work advantageously; please save correspondence by stating age experience, list of references, salary wanted, etc. Address Box 92, AMERICAN MACHINIST.

NEW JERSEY.

Screw Machine.—Wanted—Good operators on Acme and Brown & Sharpe automatics; to good men steady positions are open. Box 125, AMERICAN MACHINIST.

Wanted—Mechanical draftsman, qualified to design new machinery, in nearby town; position temporary; give age, experience and pay required. Box 120, AMER. MACHINIST.

NEW YORK.

Wanted—Experienced toolmakers and lathe hands for day and night shifts, building line of air compressors; good opportunities for energetic men. Address, stating experience, wages expected and references, Imperial Engine Co., Painted Post, N. Y.

Wanted—Man of practical experience in designing, manufacturing and operating gasoline engines, marine and stationary; management of department open to capable applicant; state age, experience and salary desired. Box 117, AMERICAN MACHINIST.

Wanted—Experienced inspector capable of taking charge of department; must be accustomed to thoroughly up-to-date methods; experience on gun and rifle parts preferred. Address, stating experience and salary expected, Box 124, AMERICAN MACHINIST.

Wanted—To correspond with experienced men with executive ability; competent to take foreman's position in the different departments of large factory manufacturing shotguns and rifles. Address, stating experience and salary expected, Box 123, AM. M.

High-Class Opportunities.—Many changes are made around the first of the year. We know where these changes are. We desire, among other positions, manager sales manufacturing, $2,000; mechanical engineer, $1,800; salesman, $1,500; bookkeeper, $1,200. Inquire Business Opportunity Company, 1 Union Square, New York.

OHIO.

Wanted—Man, with practical experience in manufacturing, to take charge of tools and production in factory. Address Box 68, AMERICAN MACHINIST.

Wanted—Foreman to take entire charge of small shop with good tools and good work. Address "Cincinnatus," care AMERICAN MACHINIST. Correspondence confidential.

Wanted—Foreman for machine shop manufacturing two-cycle gas engines and oil-country machinery, employing about 25 men; state experience and salary expected. Address Box 126, AMERICAN MACHINIST.

PENNSYLVANIA.

Wanted—First-class designing draftsman, technical graduate, familiar with engine and compressor design; also two or three good patternmakers. Address Box 111, AM. M.

Our business is constantly increasing and we invite applications from machine and floor hands, accustomed to machine tool work. Standard Engineering Works, Ellwood City, Pa.

Wanted—A man competent to take charge of a jobbing foundry and machine shop, as superintendent; must have knowledge of mixture of metals and machine work. Box 121, AMERICAN MACHINIST.

Draftsman.—Mechanical draftsman wanted, with first-class experience in designing general machinery and furnace work, preferably in steel works; state age, experience, reference and salary expected. Address P. O. Box 1606, Philadelphia.

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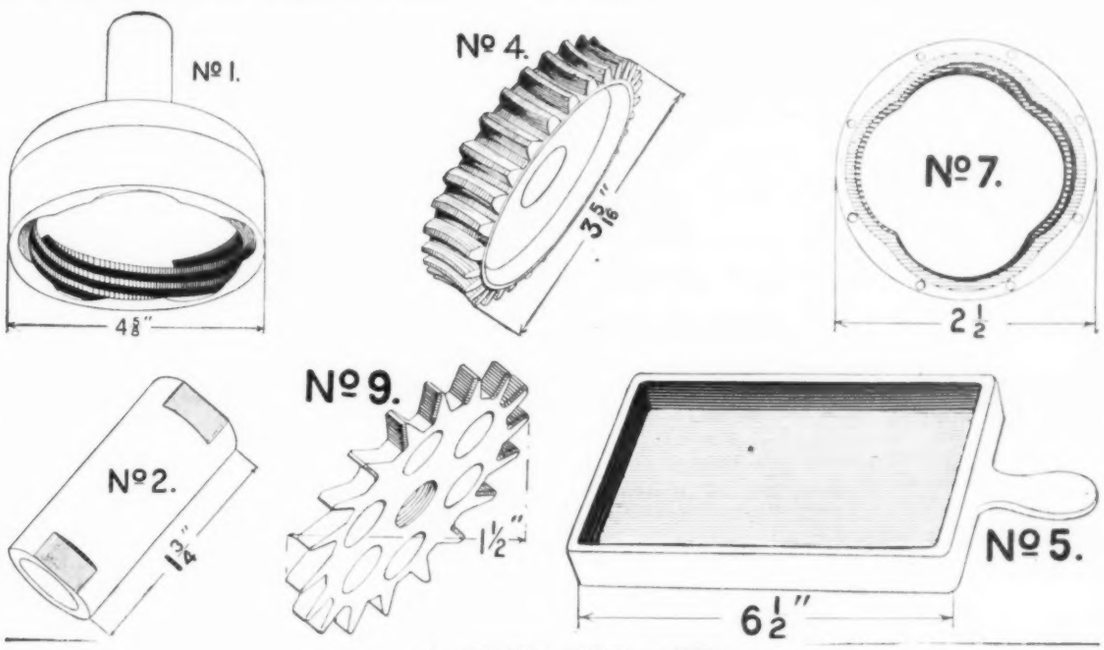

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New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.

Clutches, Magnetic and Electrical
Electric Controller & Supply Co., Cleveland, O.
Williams Elec. Mach. Co., Akron, Ohio.

Coils
Standard Welding Co., Cleve., O.

Compound, Pipe Joint
Dixon Crucible Co., Jos., Jersey City, N. J.

Compressors, Air
Blaisdell Machy. Co., Bradford, Pa.
Chicago Pneu. Tool Co., Chicago, Ill.
Christensen, N. A., Milwaukee, Wis.
Curtis & Co. Mfg. Co., St. Louis, Mo.
General Pneumatic Tool Co., Montour Falls, N. Y.
Herron & Bury Mfg. Co., Erie, Pa.
Ingersoll-Sergeant Drill Co., New York.
Rand Drill Co., New York.

Cones, Friction
Evans Friction Cone Co., Boston, Mass.

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Leard, Wm. E., New Brighton, Pa.
Standard Connecting Rod Co., Beaver Falls, Pa.
Tindel-Morris Co., Eddystone, Pa.

Contract Work
Blanchard Mach. Co., Boston, Mass.
Gray's Ferry Mach. Co., Philadelphia, Pa.

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Electric Controller & Supply Co., Cleveland, O.
General Electric Co., New York.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

Coping Machines
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.

Correspondence Schools
See Schools, Correspondence.

Counterbores
Slocomb Co., J. T., Provi., R. I.

Countershafts
Almond Mfg. Co., T. R., Brooklyn, N. Y.
Builders' Iron Fdry., Prov., R. I.
Smith Countershaft Co., Melrose, Mass.

Counting and Printing Wheels
Franklin Mfg. Co., Syracuse, N. Y.

Couplings, Shaft
Almond Mfg. Co., T. R., Brooklyn, N. Y.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Davis Mach. Co., W. P., Rochester, N. Y.
Electric Controller & Supply Co., Cleveland, O.
Howard Iron Wks., Buffalo, N. Y.
Niles-Bement-Pond Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.

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Case Mfg. Co., Columbus, O.
Chambersburg Engineering Co., Chambersburg, Pa.
Chicago Pneu .Tool Co., Chicago, Ill.
Cleveland Crane & Car Co., Wickliffe, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
General Pneumatic Tool Co., Montour Falls, N. Y.

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Lane Mfg. Co., Montpelier, Vt.
Maris Bros., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Pawling & Harnischfeger, Milwaukee, Wis.
Sellers & Co., Wm., Phila., Pa.
Vandyck Churchill Co., New York.

Crank Pin Turning Machine
Niles-Bement-Pond Co., New York.
Underwood & Co., H. B., Philadelphia, Pa.

Crank Shafts
Leard, Wm. E., New Brighton, Pa.
Standard Connecting Rod Co., Beaver Falls, Pa.
Tindel-Morris Co., Eddystone, Pa.

Crucibles
Dixon Crucible Co., Jos., Jersey City, N. J.

Cupolas, and Ladles, Foundry
Northern Engr. Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Paxson Co., J. W., Phila., Pa.

Cut Meters
Warner Instrument Co., Beloit, Wis.

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Adams Co., Dubuque, Iowa.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Gay & Ward, Inc., Athol, Mass.
Ingersoll Milling Mach. Co., Rockford, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Whitney Mfg. Co., Hartford, Ct.

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Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Davis Mach. Co., W. P., Rochester, N. Y.
Hurlbut-Rogers Mach. Co., South Sudbury, Mass.
Newton Mach. Tool Wks., Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Vandyck Churchill Co., New York.

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Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
O. K. Tool Holder Co., Shelton, Conn.
Pratt & Whitney Co., Hartford, Conn.

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Osgood, J. L., Buffalo, N. Y.
Steel Set Diamond Co., New York.

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Bliss Co., E. W., Brooklyn, N. Y.
Perkins Mach. Co., Warren, Mass.

Dies, Threading, Opening
Errington, F. A., New York.
Geometric Drill Co., New Haven, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Hartford, Conn.

Dowel Pins
Winkley Co., Hartford, Conn.

Drafting Machines
Universal Drafting Mach. Co., Cleveland, O.

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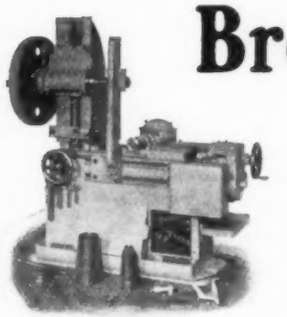
Keuffel & Esser Co., New York.
Rich, J. & G., Philadelphia, Pa.

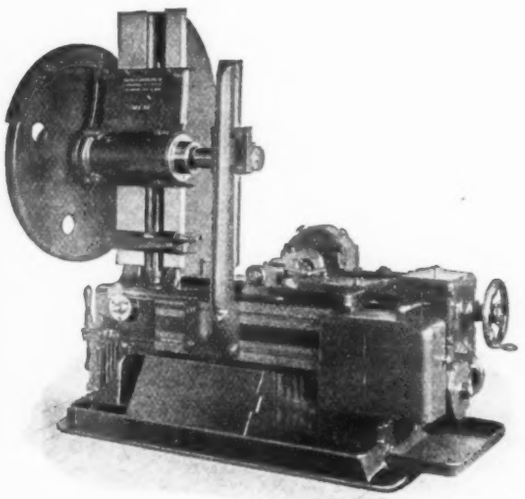
Drawing Materials
Alteneder & Sons, Theo., Philadelphia, Pa.
Hardtmuth, L. & C., New York.
Keuffel & Esser Co., New York.

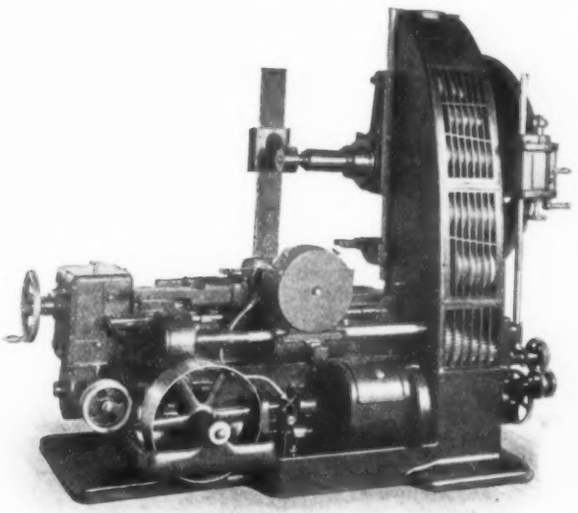


Brown & Sharpe Mfg. Co.

Providence, R. I., U.S.A.

Automatic Gear Cutting Machines





All parts proportioned to withstand the most severe service to which the machine should be subjected. This insures Accuracy in the finished product.

Cutter Spindle. Hardened steel. Powerfully and smoothly driven by worm gearing. Cutter Arbor, large diameter; has hardened sleeve running in outer bearing. Cutter speeds obtained by change gears; speeds in geometrical progression.

Cutter Slide. Return rapid. Operated by independent and constant drive. Can be run back to extreme rear position without disturbing setting of dogs. Ways have large bearing surfaces; narrow in proportion to length, insures maintenance of alignment.

Work Spindle. Large diameter. Rigidly mounted in heavy slide. Improved method of clamping slide to upright. Graduated dial reads to thousandths for setting to depth of cut.

Indicator. For setting Cutter central by indicating from pitch line. Surface where indicator is placed when setting Cutter retains original accuracy.

Indexing Mechanism. Positive. Operates without shock. Provision for more than one turn of locking disk, releases mechanism from heavy strain. Large diameter and extreme accuracy of index wheel. Work spindle can be turned by hand when truing arbors or work; also has fine adjustment for use in setting to recut a gear.

Feed Mechanism. Driven by screw and worm gearing; gives powerful and smooth drive. Positive clutches. Wide range of feeds in geometrical progression, obtained by change gears.

Conveniences. Indexing Mechanism can be tripped from front of Machine. All dogs and operating levers placed at front of machine, easy of access. Chips confined to pan in base. Provision for attaching pump to supply lubricant to Cutters.

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Niles-Bement-Pond Co., New York.

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Dallett Co., Thos. H., Phila., Pa.
Flather Planer Co., Mark, Nashua, N. H.
Fosdick Mach. Tool Co., Cin., O.
Garvin Mach. Co., New York.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
McCabe, J. J., New York.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Dayton, Ohio.
Newton Machine Tool Works, Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
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Cleveland Pneu. Tool Co., Cleveland, O.
General Pneu. Tool Co., Montour Falls, N. Y.
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Phila. Pneumatic Tool Co., Philadelphia, Pa.
Rand Drill Co., New York.

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Dreses Mach. Tool Co., Cincin., O.
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Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Mueller Mach. Tool Co., Cin., O.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Vandyck Churchill Co., New York.

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Niles-Bement-Pond Co., New York.
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American Tool Wks. Co., Cin., O.
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Barnes Co., W. F. & John, Rockford, Ill.
Bertram & Sons Co., Ltd., John, Dundas, Ont., Canada.
Blaisdell & Co., P., Worcester, Mass.
Boynton & Plummer, Worcester, Mass.
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Harrington, Son & Co., Edwin, Philadelphia, Pa.
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Le Blond Mach. Tool Co., R. K., Cincinnati, O.

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Mechanics Machine Co., Rockford, Ill.
New Haven Mfg. Co., New Haven, Conn.
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Pratt & Whitney Co., Hartford, Conn.
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Standard Tool Co., Cleveland, O.

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Hisey-Wolf Mach. Co., Cincin., O.
Niles-Bement-Pond Co., New York.

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Niles-Bement-Pond Co., New York.

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Roth Bros. & Co., Chicago, Ill.
Sprague Elec. Co., New York.
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Triumph Elec. Co., Cincin., O.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

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Northern Elec. Mfg. Co., Madison, Wis.
Roth Bros. & Co., Chicago, Ill.
Triumph Elec. Co., Cincinnati, O.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

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Emery Wheels
See Grinding Wheels.

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McGeorge & Sons, Cleveland, O.

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Crocker-Wheeler Co., Ampere, N. J.

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Olds Gasoline Engine Works, Lansing, Mich.

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Foos Gas Eng. Co., Springfield, O.
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Burt Mfg. Co., Akron, O.
Sturtevant Co., B. F., Hyde Park, Mass.

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General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Sturtevant Co., B. F., Hyde Park, Mass.
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Nicholson File Co., Provi., R. I.

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Ingersoll-Sergeant Drill Co., New York.
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Gould & Eberhardt, Newark, N. J.
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Gisholt Mach. Co., Madison, Wis

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Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
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Greenwald Co., I. & E., Cincin., O.
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Chicago Raw Hide Mfg. Co., Chicago, Ill.
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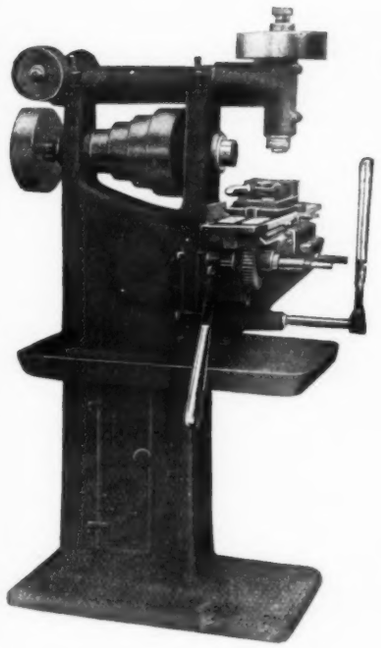
The Vertical Spindle on the

Chicago Hand Miller



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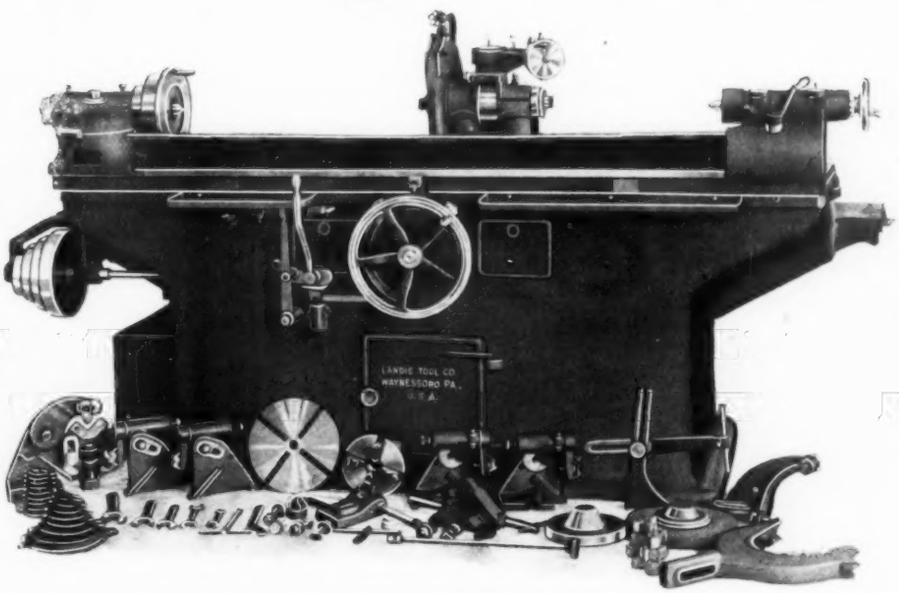

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Nuttall Co., R. D., Pittsburg, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburg, Pa.
Taylor, Wilson & Co., Allegheny, Pa.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer & Co., S., Cincin., O.

Grinders, Center
Coates Clipper Mfg. Co., Worcester, Mass.
Heald Mch. Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cincin., O.
Mueller Mch. Tool Co., Cin., O.
Niles-Bement-Pond Co., New York.

Grinders, Cutter
Automatic Mach. Co., Greenfield, Mass.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Greenfield Mach. Co., Greenfield, Mass.
Heald Mach. Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cincin., O.
Niles-Bement-Pond Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

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Diamond Mach. Co., Provi., R. I.
Heald Machine Co., Worcester, Mass.
Iroquois Mach. Co., New York.
Ransom Mfg. Co., Oshkosh, Wis.

Grinders, Drill
Heald Mch. Co., Worcester, Mass.
Niles-Bement-Pond Co., New York.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Portable
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Hisey-Wolf Mach. Co., Cincin., O.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Diamond Mach. Co., Provi., R. I.
Foster Co., Walter H., New York.
Gisholt Mach. Co., Madison, Wis.
Gould & Eberhardt, Newark, N. J.
Hisey-Wolf Mach. Co., Cincin., O.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Niles-Bement-Pond Co., New York.
Northampton Emery Wheel Co., Leeds, Mass.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, O.
Vandyck Churchill Co., New York.
Whitney Mfg. Co., Hartford, Ct.

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Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Coates Clipper Mfg. Co., Worcester, Mass.
Diamond Mach. Co., Prov., R. I.
Fairbanks Co., New York.
Foster Co., Walter H., New York.
Goodell-Pratt Co., Greenfield, Mass.

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Iroquois Mach. Co., New York.
Landis Tool Co., Waynesboro, Pa.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Niles-Bement-Pond Co., New York.
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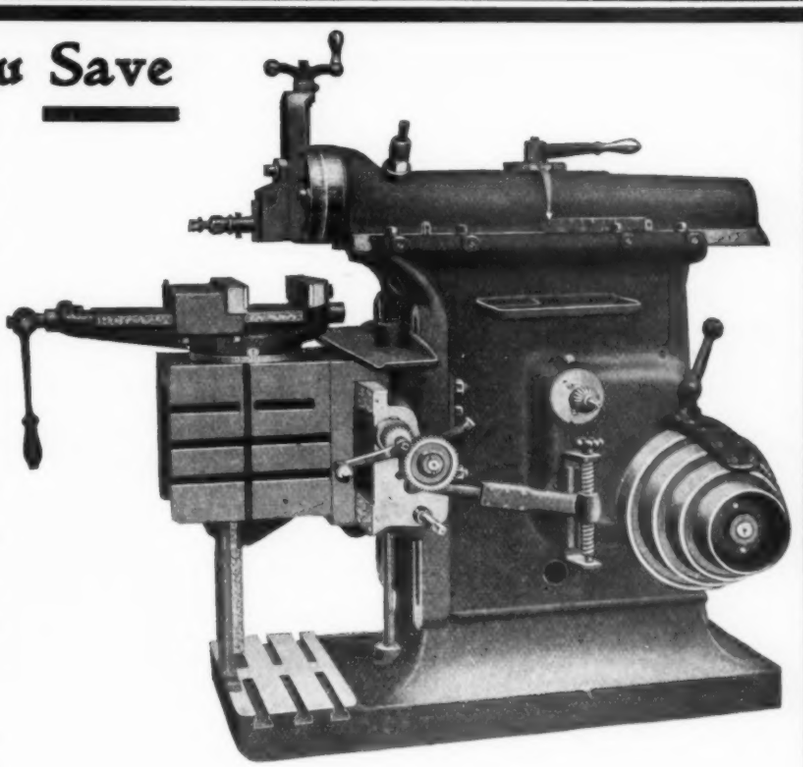

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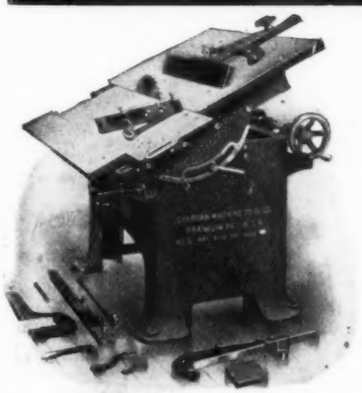

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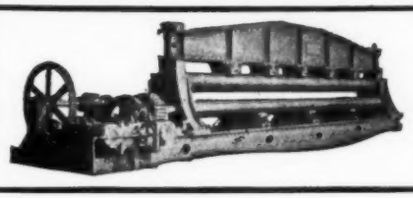

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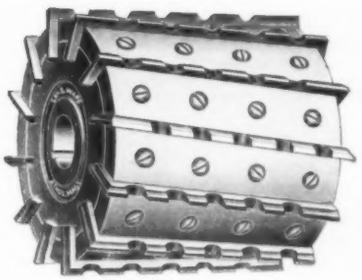

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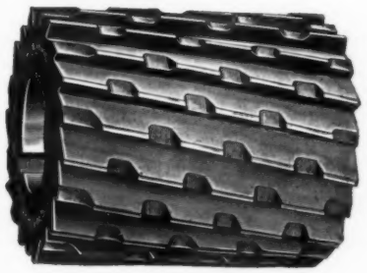

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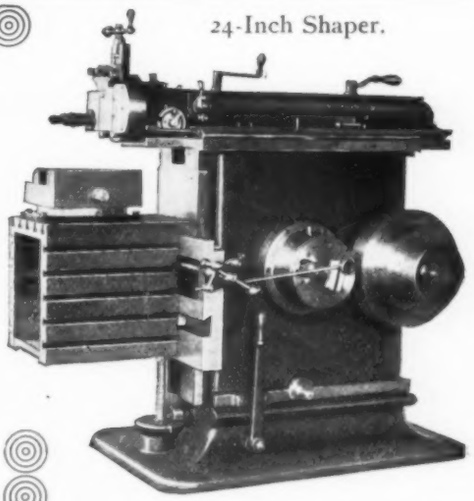

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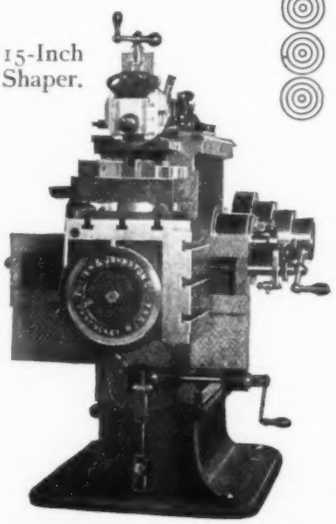

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IF YOU USE CUTTERS, WE INVITE CORRESPONDENCE.

HAMMACHER, SCHLEMMER & CO.,

HARDWARE, TOOLS AND SUPPLIES,

New Home 4th Avenue and 18th Street, Block South of Union Square.

NEW YORK, SINCE 1848.

AN ORDER FOR 13,000,000 STEEL BALLS

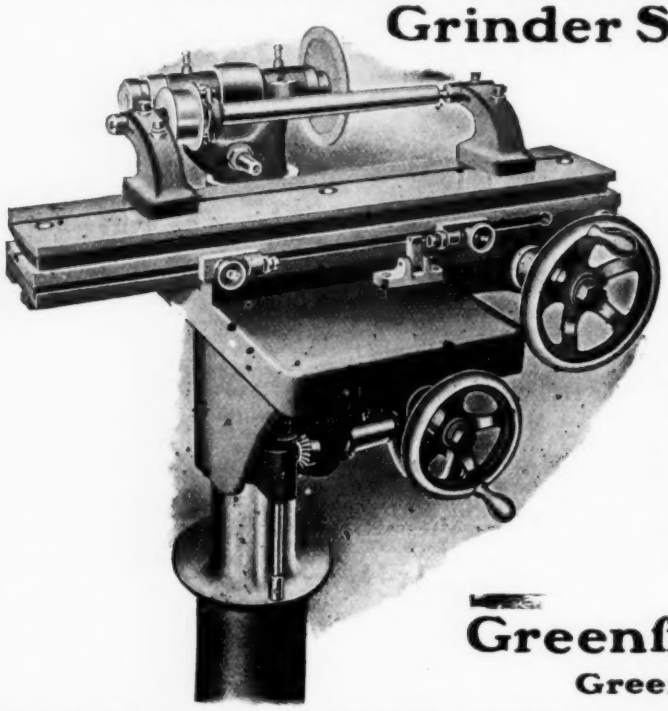
This is the largest order on record. It was recently placed with us by the Acme Ball Bearing Caster Co., of Chappaqua, N. Y. It is certainly worth while describing the product which requires so many balls. The Acme caster has this pre-eminent advantage over all other casters. Its head is a large ball set in a socket and rolling on forty smaller balls. It carries its load directly over the center of gravity and so the heaviest weights may be moved by the hand of a child

Good idea, isn't it?

By the way, the 13,000,000 balls we have contracted to make for these casters will be first grade, one-eighth inch in diameter. We couldn't tackle such an order if our output wasn't in excess of 1,000,000 a day

FEDERAL MANUFACTURING COMPANY—CLEVELAND, OHIO

Rapid Production Starts with Sharp Tools. The Greenfield Improved Universal Grinder Sharpens All Tools



such as gear and milling cutters, end cutters, rosebits, taps, dies, counterbores, etc.

It will also do plane, cylindrical and internal grinding; parallel, surface, angular, gage, and, in fact, almost every kind of grinding possible.

This handy, convenient tool will quickly save its cost. It is just the thing for the tool room, and, because of its simplicity, it does not require an expert operator.

For full particulars and illustrations, showing many of its uses, send postal for book.

Greenfield Machine Co.
Greenfield, Mass., U. S. A.

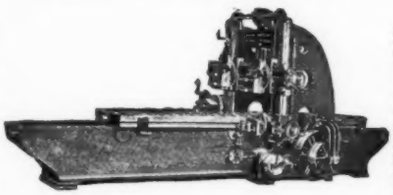
SIMPLICITY distinguishes the new SPEED VARIATOR on the DRESES RADIALS

7 Changes by one lever.
14 Changes by two levers.
No Friction Clutches.
Changes easily and positively.
Ideal Drive in connection with Constant Speed Motors.
We make the most complete line of Radials in the country.

DRESES MACHINE TOOL CO., Cincinnati, Ohio.

REPRESENTATIVES—Manning, Maxwell & Moore, New York, Philadelphia, Boston and Chicago; Carey Machinery and Supply Co., Baltimore; Baird Machinery Co., Pittsburg; Wm. C. Johnson & Sons Machinery Co., St. Louis; Pacific Tool and Supply Co., San Francisco and Hawaian Islands; Selig, Sonnenthal & Co., London; C. Schinz, St. Petersburg; G. Koeppen & Co., Moscow; V. Lowener, Copenhagen and Stockholm; Van Rietschoten & Houwens, Rotterdam; Wilh. Sonesson & Co., Malmo, Sweden; Stussi & Zweifel, Milan, Italy.

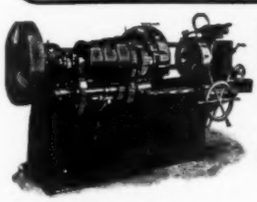
THE BELMER HEAVY PLANER.



POINTS:
Solid and rigid design.
2, 3 or 4 heads.
For heavy feeds and cuts.
Best materials only.
High class workmanship.
Every convenience.
Unusual depth of V's.
Roller lubrication.
Ball bearing elevating screws.
More in catalog. Get it.

Any size from 30" up.

BELMER MACHINE TOOL CO., Cincinnati, Ohio.



Pipe Threading Machinery

Bolt Threaders. Hand Stocks and Dies. Pipe Cutting-off Machines. Pipe Couplings for Gas Lines.

STANDARD ENGINEERING WORKS, Ellwood City, Pa., U. S. A.

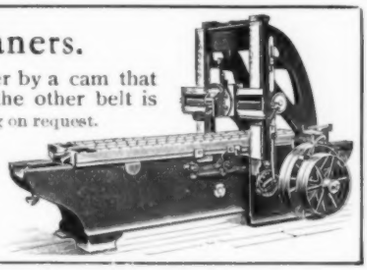
New York Office: 123 Liberty St. 1012 Chemical Bldg., St. Louis, Mo.

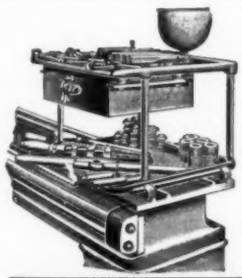
Woodward & Powell Planers.

Belts are shifted from either side of planer by a cam that shifts one belt onto loose pulley before the other belt is shifted onto the tight pulley. Catalog on request.

Woodward & Powell Planer Co.,
Worcester, Mass., U.S.A.

Robinson & Cary Co., St. Paul, Minn.
W. M. Pattison Mach'y Co., Cleveland, O.
Milner & Kettig, Birmingham, Ala.
Manning, Maxwell & Moore, New York City, Philadelphia, Pa., Chicago, Ill., and Pittsburg, Pa.





This Little Lathe Rack

Will save you the trouble of looking for tools. It has a place for everything and keeps them where you can reach them quick when you want one. It has a bowl for oily waste and a drawer with a lock to hold micrometers and the more expensive tools that sometimes walk off. This costs only $8 25, and if you don't need the drawer it's only $6 75. We make Racks for every purpose and place. The book explains.

The New Britain Machine Company,
NEW BRITAIN, CONN., U. S. A.

MOLINE GANG DRILL

Has removable heads; all heads or one may be used, as desired.
Get details of this new, different Gang Drill.

MOLINE TOOL COMPANY,
MOLINE, ILL., U. S A.

BOLT CUTTERS.

Reliance are the kind that adjust quickly and stay adjusted cut perfect threads, and never force the dies onto the threaded bolts to release them Write for details.

Reliance Machine and Tool Co.
CLEVELAND, OHIO, U S.A.

A Handle Of Steel

Proof against fire, acid, steam, dry heat and rough usage.
It's the genuine COES Screw Wrench, fully warranted. Want catalog?

Coes Wrench Co., Worcester, Mass.

Selling Agents.
J. C. McCarty & Co., 10 Warren St., New York.
John H. Graham & Co., 113 Chambers St., New York.

DIAMOND TOOLS
OF ALL KINDS

For Turning Hard Rubber and Carbon.
Emery Wheel Dressers
The Steel Set Diamond Co.
36 Gold Street, New York.

Keyways Are Quickly Cut

and are accurately cut on the Catlin Keyway Cutting Machine. It's simple, and is adapted to a large range of work. Described in the book.

Chattanooga Machinery Co.,
CHATTANOOGA, TENN., U.S.A.
Toronto Canada, H. W. Petrie.

BOOKS AND THINGS

A Screed On Discounts.

Don't ask for discounts on Books and things you get from The Derry-Collard Co.

Because "there'll be nothing doin."

Except:

When you buy in a quantity you get a discount the same as when buying any commodity at wholesale, or—

When you are an agent or dealer.

No one gets a discount otherwise.

A title or a diploma won't let you in to a discount.

Don't ask.

The reasons for this thusness are in part, as follows:

In the first place the granting of discounts to some and not to others isn't a square deal to the others, the others being the boys at from $12.00 to $16.00 a week who should have a discount if anyone should.

The Derry-Collard Co. doesn't believe in handicapping the man who is struggling forward.

'Tisn't right, 'tisn't square.

So everyone gets the same deal.

If the price of a book or whatever is $1.50, $2.50, or 10 cents, that's the price; no more, no less.

So much for one reason against discounts.

Here's another reason:

The Derry-Collard Co. has an "on approval" service, which puts any technical book into your hands at no cost and allows you to "see the goods" before you let go of the price.

The maintenance of this service costs a lot of money and—

If the privilege of having things to look over before you pay for them isn't worth the difference between having to put up in advance, at a discount, ask us.

Suppose you get your $2.50 book for $2.35 or whatever the discount may be, and it turns out to be something you have no use for; where do you get off in the matter of the $2.35? You've got $2.35 worth of book you don't want and the $2.35 is nix.

The Derry-Collard Co. puts the $2.50 book into your hands at no cost; if it's what you want, send the $2.50, if it isn't send the book back and you've still got your $2.50.

These are the reasons why no discounts obtain with the D.-C. Co.

So don't ask.

'Cause there'll be none coming.

Presently some one will spring this advertisement on you and ask you "how about it."

Tell them for us:

That The Derry-Collard Co. has come out of the darkness into the first place in technical book selling in two short years—one of them the worst that ever happened—because it had the courage to do things differently and that the transgression of cherished precepts of the long ago has brought it about and that The Derry-Collard Co. will surely maintain the first place by just such apparently suicidal means as this discount stand.

* Folder describing method on request.

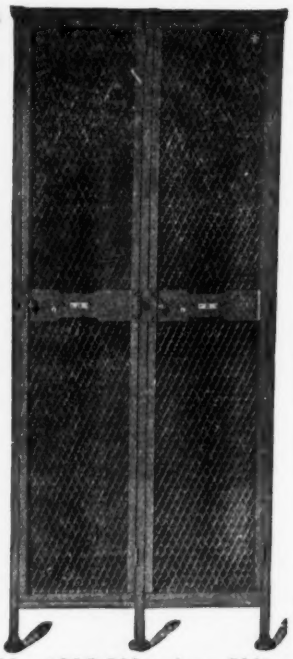
▼ ▼ ▼

The Derry-Collard Company,
257 Broadway, NEW YORK

The Locomotive Publishing Co., Ltd.,
3 Amen Corner, Paternoster Row, London, W.C.

Cable Address, "Derycolard," N. Y.

LOCKERS MADE BY US

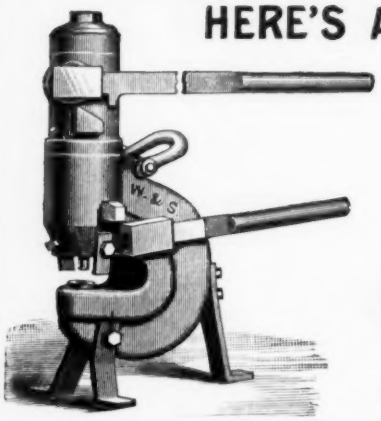


of expanded metal or sheet steel insure a positive security and have points of superiority over all others. We also make metal shelving, screens and enclosures.

Write for catalog.

MERRITT & CO., 1025 Ridge Ave., Phila.

HERE'S A HYDRAULIC PUNCH

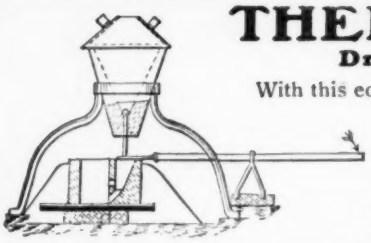


that is made by us and therefore O.K. You may not have had your attention called to the fact that this punch can be pushed down to the work without pumping. All the pumping does actual punching, and that's a saving of muscle and time.

Made to usual W. & S. standards, and we're just waiting to tell you all about it.

Watson-Stillman Co.
46 Dey Street, New York City.
WORKS: ALDENE, N. J.
Chicago Office—453 Rookery. Selig, Sonnenthal & Co., London.

THERMIT PROCESS
Dr. Goldschmidt Patents.



With this equipment you obtain anywhere in ½ a minute:

1. *Heat about 5400° F.*
2. *Pure Metals free from carbon,* amongst them pure steel.

You use this combination to weld iron and steel of any section, rails, girders, pipes, etc. **Titan Thermit** prevents blowholes in castings.

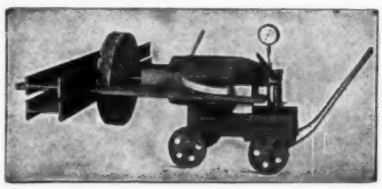
Goldschmidt Thermit Co., 43 Exchange Place, New York.

IT WILL PAY YOU
to have a permanent exhibit of your
Machinery and Mechanical Appliances
IN THE
EXHIBITION DEPARTMENT OF

THE BOURSE, Philadelphia
Write for Further Information

Crank Disc Pins That "Stick"

release their hold pretty quickly when our Portable Hydraulic Press with its 60 to 100 tons pressure gets hold of them. No lugging—no tugging—wheel it right up to the work and save time and trouble. It is also adapted for removing shafting from sheaves, and a wide variety of other work. Elmes guarantees it in every respect and the price is right. Send for Circular No. 21, which describes it fully.



Chas. F. Elmes Engineering Works, Estab. 1863. 250-258 Fulton St., Chicago, Ill., U.S.A.

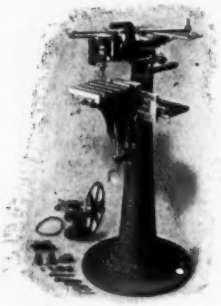
Shapers, Drilling Machines, Belt Cutting and Nut Tapping Machines and Machinists' and Blacksmiths' Forges.

For cuts and details see large ad in first and third issues of the month. Catalog will be sent on request.

Boynton & Plummer,
P. O. Box 27,
Worcester, Mass., U. S. A.

THE
NEW YANKEE DRILL GRINDER.
Catalog is yours for the asking.
WILMARTH & MORMAN CO.,
157 Canal Street, Grand Rapids, Mich.

This Tool is an Engraving Machine. It is for



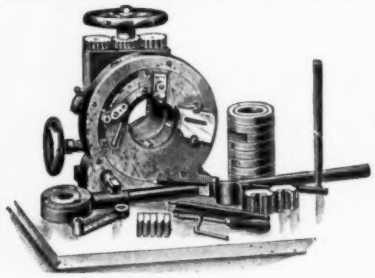
engraving letters, figures and the like for name plates, direction plates, dies, seals and for all work of a kindred nature usually done by hand. Not only is the work done better than it can be done by hand, but it is done in a fraction of the time We'd like to engrave a few pieces for you just to give you an idea of time and quality, and to send our catalog.

Geo. Gorton Machine Co.
RACINE, WIS.

Established 1874.

The S. Obermayer Co.,
Cincinnati, O. Chicago, Ill. Pittsburg, Pa.
Manufacturers

"Everything you need in Your Foundry." Builders—Modern up-to-date Foundry Equipment. Makers—High Grade Foundry Facings and Blackings. Send for general catalogue A, No. 100. Sent to any foundryman in the world.

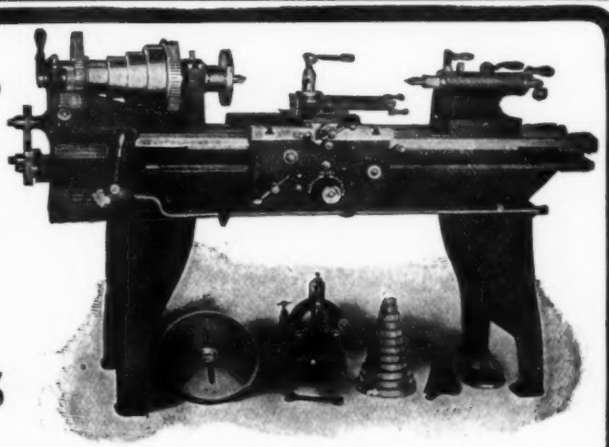


When Pipes Play Out

and have to be cut off or replaced in a hurry, our Hand Pipe Threading and Cutting Machine is a mighty handy and profitable tool to have around. It is portable, it has our Standard Adjustable Quick Opening and Closing Die Head, and our Improved Cutting Off Knife. It will cut and thread pipe better and quicker and easier than any other hand machine, and will make quicker changes from one size of pipe to another. Four sizes: No. 5, 1 in. to 4 in. pipe; No. 6, 1 in. to 6 in. pipe; No. 9, 2½ in. to 8 in. pipe; No. 11, 4 in. to 12 in. pipe. Catalog No. 5 tells all about them.

THE MERRELL MFG. CO.,
100 Curtis St., Toledo, Ohio.
European Office—The Fairbanks Co., 78 80 City Road, E. C., London.

"Star"



STAR TRADE MARK REGISTERED

Lathes

14-in. x 6 ft. "Star" Screw-Cutting Engine Lathe.

are just the tools that the ordinary, every day shop can make money with. They are made from 9 to 14 in. swing, and they're made well.

The price is low, but that feature doesn't affect the quality, for they have forged crucible steel hollow spindles, phosphor-bronze bearings, gear-driven reversible feeds with strong friction drive in apron, our patented spring nuts which allow quick shifts of change gears and many other convenient and valuable features. **We also make Bench Lathes, Foot Lathes and Speed Lathes. Ask for catalog "B," giving full descriptions.**

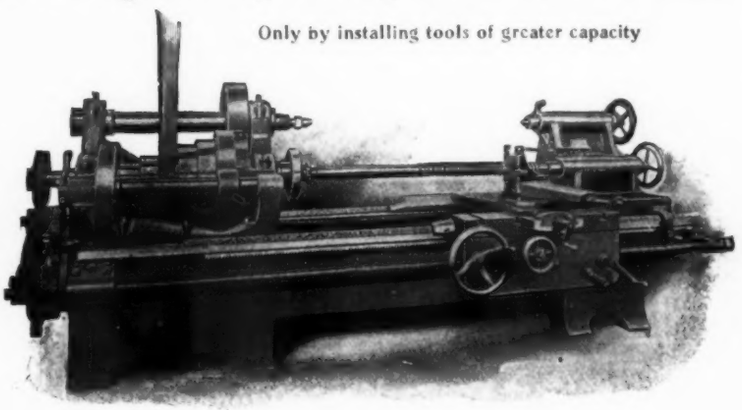
THE SENECA FALLS MFG. CO.,

687 Water Street, SENECA FALLS, N. Y., U. S. A.

AGENTS—Montgomery & Co., New York. A. J. Wilkinson & Co., Boston. Wm. P. Walter's Sons, Philadelphia. Baird Machinery Co., Pittsburg. O. L. Packard Machinery Co., Chicago and Milwaukee. Scott Supply & Tool Co., Denver. Pacific Tool & Supply Co., San Francisco. (82A)

When A Shop Is Limited In Size Its Capacity May Be Increased

Only by installing tools of greater capacity



A McCabe Double-Spindle Lathe

Won't occupy any more space in a shop than any other large lathe will, and yet, in addition to all the advantages which it possesses as a 26″ lathe, it is equally efficient as a 48″ lathe. This means it will be kept busy all the time, and the cost is only half as much as an ordinary 48″ lathe. The details are very interesting, and will be sent on request.

J. J. McCabe, 14 Dey Street, New York City

Chas. Churchill & Co., Ltd., London, Birmingham, Manchester and Glasgow.

Matthews' High-Speed Steel Reamers.

Cutting edges of high-speed steel brazed into a body of soft steel—practically one solid piece. Circular free.

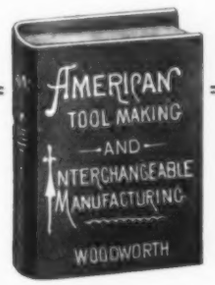
THREE RIVERS TOOL COMPANY,
DEPT. K, THREE RIVERS, MICH.

Vitrified Corundum Wheels.

Fast cutting.
Non-glazing.
Clean cut.
Will not heat.
More points in Catalog.

The Vitrified Wheel Co.,
Westfield, Mass.

JUST PUBLISHED.



American Tool Making and Interchangeable Manufacturing,

BY JOSEPH V. WOODWORTH.

Price, $4.00,

Prepaid to any address in the world.

A complete practical treatise of 544 pages and 600 detailed illustrations on American Tool Making and system of Interchangeable Manufacturing as carried on to-day in the United States. Describing and illustrating all of the different types and classes of small Tools, Fixtures, Devices, and Special Appliances which should be in general use in all machine manufacturing and metal working establishments where economy, capacity and interchangeability in the production of machined metal parts are imperative.

All the tools, fixtures and devices illustrated in this book, have been or are used, for the actual production of work, such as parts of Drill Presses, Lathes, Patented Machinery, Typewriters, Electrical Apparatus, Mechanical Appliances, Brass Goods, Composition Parts, Mould Products, Sheet Metal Articles, Drop Forging, Jewelry, Watches, Metals, Coins, etc.

The treatment of each tool described and illustrated is such as to enable any practical man to Design, Construct and Use Special Tools, Dies and Fixtures, for the Rapid and Accurate Production of Metal Parts Interchangeably.

Every Machinist, Tool Maker, Designer, Diemaker, Superintendent, Manager and Shop Proprietor should have this book as it shows the 20th Century Manufacturing Methods and Assists in reducing the Expense and increasing the Output and the Income.

Mechanical Appliances, Mechanical Movements and Novelties of Construction,

BY GARDNER D. HISCOX, M.E.

A new and complete Work and a Continuation as a Second Volume of the Author's Work "Mechanical Movements, Powers and Devices."

Illustrated by 1,000 specially made engravings.

Price, $3.00.

The ten editions through which the first volume of "Mechanical Movements" has passed is more than a sufficient encouragement to warrant the publication of a second volume, more special in scope than the first, inasmuch as it deals with the peculiar requirements of various arts and manufactures, and more detailed in its explanations, because of the greater complexity of the machinery selected for illustration.

Under each section, of which there are twenty-three, are grouped numerous characteristic types of motion and devices. The last section is unique in its explanation of the leading conceptions in the perpetual motion idea, existing during the past three centuries. We recommend this work most heartily to all inventors, patent attorneys, machinists, engineers, and all engaged in the mechanical arts.

Electric Furnaces and Their Industrial Applications,

BY J. WRIGHT.

The only American Work on the Subject.

Contains 285 pages, and 57 illustrations, which are essentially in the nature of sectional diagrams, representing principles of construction. This is a timely and practical treatise on the forms and uses of electric furnaces in Modern Electro-Chemical processes. It is of special value to those desirous of qualifying themselves to fill important positions in Electro-Chemical Establishments.

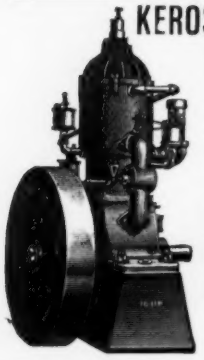
Price, $3.00.

☞ A special detailed circular of these books will be sent to anyone in any part of the world on application.

FREE—Our 114-page catalog of Practical Books for Machinists and all other trades, sent free on request.

THE NORMAN W. HENLEY PUB. CO.,
15 Beekman St., New York, U. S. A.

KEROSENE OIL ENGINES



MARINE, STATIONARY, PORTABLE.

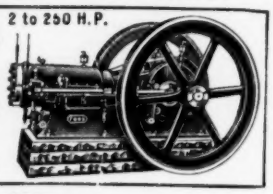
Maximum Power, Lightest Weight. Simple, reliable, economical. No batteries. Self-ignition by compression. Fully guaranteed. Write for catalog.

NO DANGER.

International Power Vehicle Company,

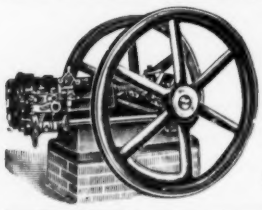
Stamford, Conn.
P. O. Box G.

FOOS 2 to 250 H.P.



For all purposes. Ask for catalog "M."

The Foos Gas Engine Co.,
Springfield, O.

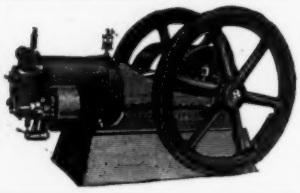


NEW ERA GAS ENGINES

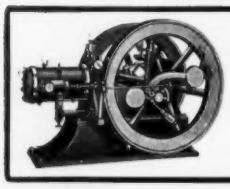
2 to 125 H.P.
For Gas or Gasoline.

The New Era Gas Engine Co.,
25 Dale Ave.,
DAYTON, O., U.S.A.

"Jacobson"
Gas and Gasoline ENGINE
5 to 300 H. P.



Jacobson Machine Mfg. Co.,
WARREN, PA., U.S.A.



The Burger Automatic Gas Engine

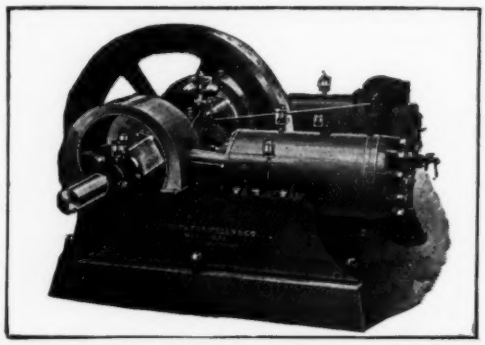
consumes 1 lb. of coal per H. P. Particulars in catalog.

Woolley Foundry and Mach. Works,
P.O. Box 500,
ANDERSON, IND., U.S.A.

Regal Engines

Stationary and Marine. Four cycle type, jump spark ignition, high grade and reliable. Engines in stock for prompt shipment. Write for Catalogue "14."

REGAL GASOLINE ENGINE CO.
Coldwater, Mich., U.S.A.



The Warren Gas Engine.

Awarded Gold Medal at Pan-American Exposition, 1901.

Single Cylinders, 3½ to 90 Actual H. P.
Double Cylinders, 25 to 500 Actual H. P.

Large sizes in successful operation, driving dynamos for lighting and power purposes. Inquiries solicited for large units to operate with natural, illuminating or producer gas.

Struthers-Wells Company,
WARREN, PA.
New York Office: No. 26 Cortlandt Street

Your Crank Shaft Troubles and Expenses

are reduced to a minimum when you order from us, because we furnish them finished, ready for use, made from your own detailed drawings, thereby relieving you of all chance for loss in defective forgings or finishing, as we take these chances. We make a specialty of these articles, and are prepared to furnish them from a good grade of open hearth steel, and finished exact to dimensions specified. The same is also true of our finished valve stems, made to order only. Send blue prints, and state quantities desired, for prices.

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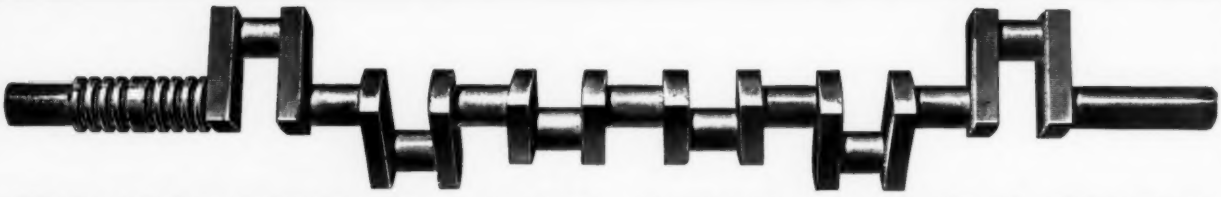

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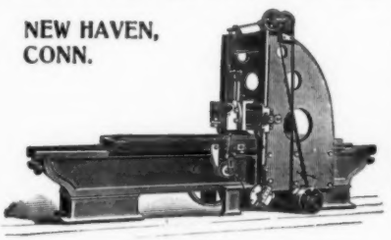

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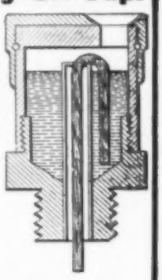

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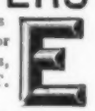

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This gauge is admirably adapted for light work. The base is steel, nicely finished and *case-hardened*, with depressions milled in the sides for the thumb and finger to grasp. The top side of it is slotted, and the rocking bracket is pivoted in the same. There is a stiff spring under one end of the bracket and a knurled adjusting screw in the other; the spindle jointed to this may be set and rigidly held in any position from vertical to horizontal, and the scriber placed in position to be used below its base for depth gauge, or (with bent end down) a scribing gauge. A V-shaped groove in the end and bottom adapts it for use on cylindrical work. There is a small hole in the clamp next to the base in which the scriber may be used for light work, the spindle being removed. An auxiliary guide piece is furnished to clamp to the base.

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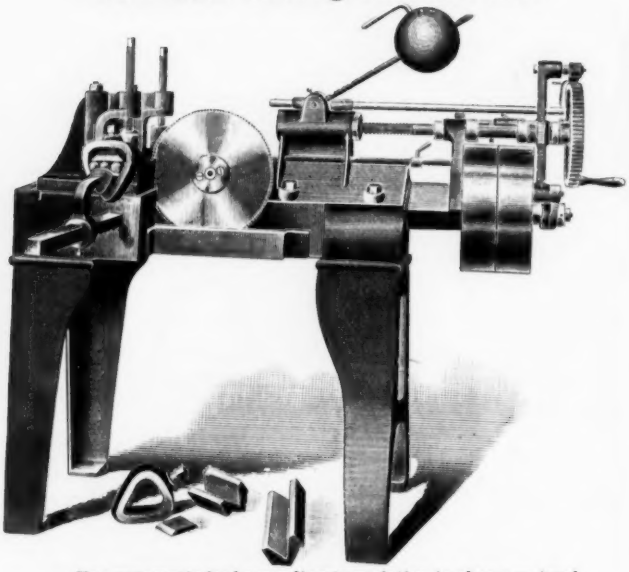
Cold Saw Cutting-Off Machine.



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Automatic throwing out of feed when cut is completed. Many other advantages.

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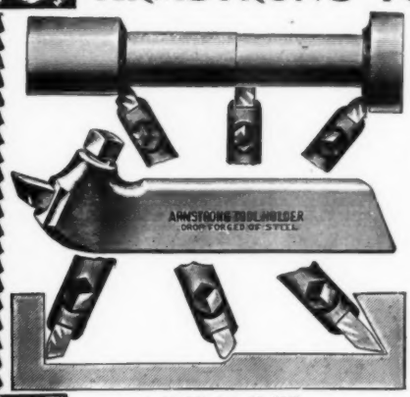

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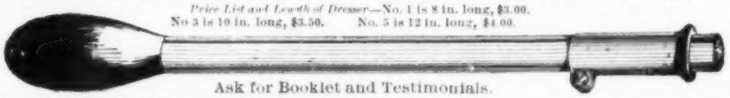

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Screw Device operates Table. With or without Back Gears. Self Feed. Reverse motion or Automatic Stop.

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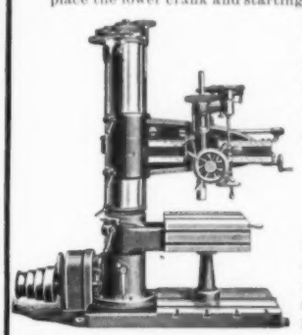
Follow the Instructions

Our new 16-speed radial has a speed plate, instructing the operator immediately where to place the lower crank and starting lever for proper spindle speed to suit any size drill from ¼ inch to 2½ inch, either in cast iron or steel.



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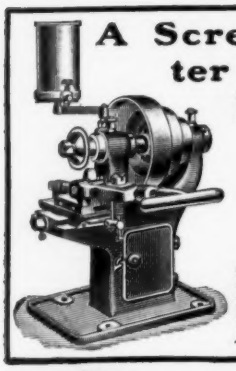

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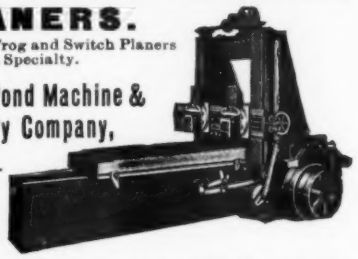

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for removing steel from brass scrap, iron from foundry sand, emery, etc.

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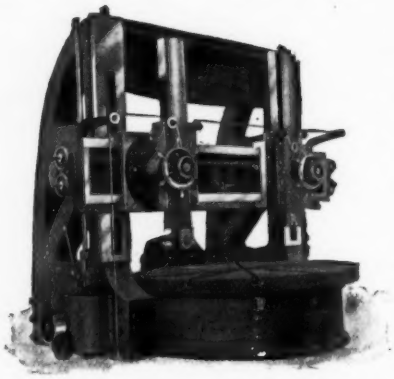

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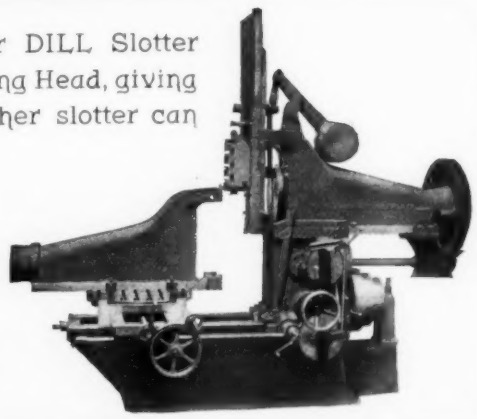

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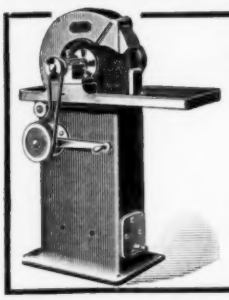

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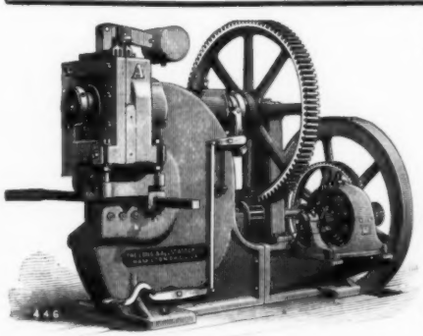

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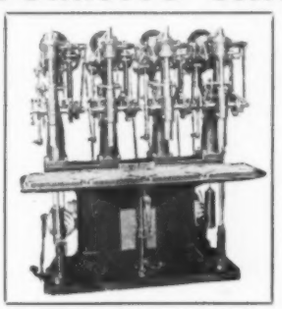

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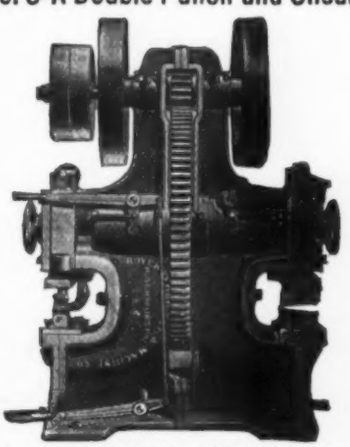
No. 3-A Double Punch and Shear



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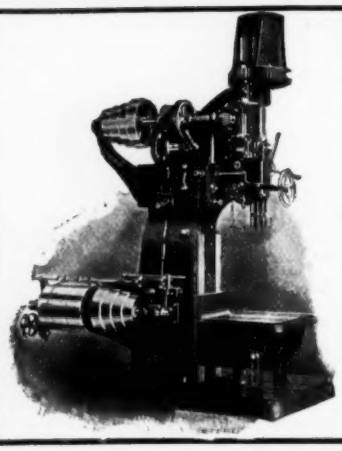
HIGHEST AWARDS IN ALL CLASSES.



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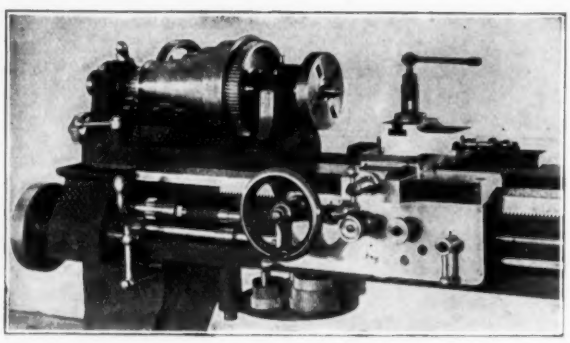

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Years ago, Flather set the pace in lathe building and Flather has maintained the pace ever since. When new lathe conditions arose Flather has been the first to meet them. The maintenance of Flather quality has been ever the first consideration and nothing is left undone to keep the Flather equal to all requirements in every way. The ownership carries an assurance of gain. From 13″ to 30″ swing. Catalog?

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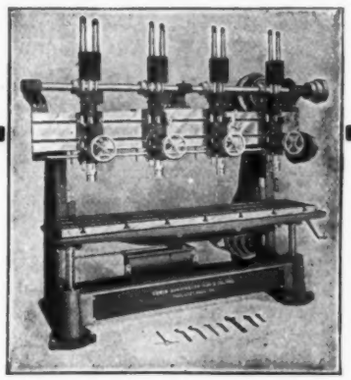

Four Holes at a Time, If You Like—

can be drilled on the Harrington Multiple with as much ease and with as great accuracy as though all the time and attention were devoted to one hole.

Three holes, two or one, can be done just as readily on this very convenient tool, and if you have any amount of drilling to do, you will make no mistake in getting one of these multiples. Being made by Harrington, it is made as strong and as ship-shape as possible, and the details, dimensions and-so-forth are contained in our Catalog, which we will be glad to send you.

Edwin Harrington, Son & Company, Inc.

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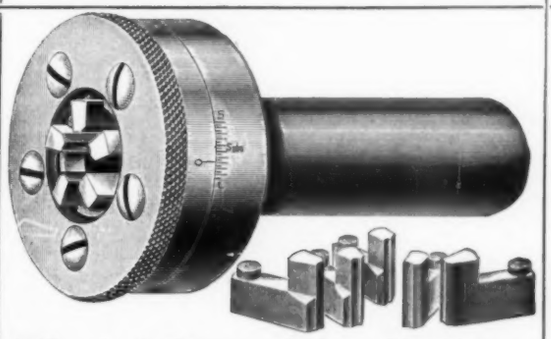
Machine Tool and Chain Hoist Builders.



The Adjustable Hollow Milling Tool

Is a time and money saving device for brass finishers. With it work can be reduced to the exact diameter with one cut; and as the body and shank are hollow it will mill work of any length. It will cut right up to a shoulder; can instantly be adjusted, and only takes a few minutes to resharpen dies.

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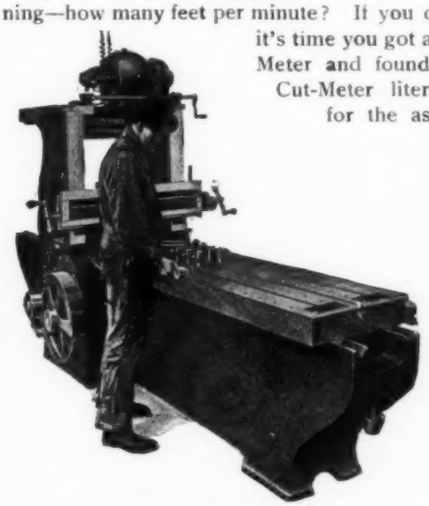
FOREIGN AGENTS—Chas. Churchill & Co., Ltd., London, Birmingham, Manchester, Glasgow, Newcastle-on-Tyne. Schuchardt & Schutte, Vienna, Cologne, St. Petersburg, Brussels, Stockholm, Paris.

You've Got a Planer. Are You Getting Its Full Productive Capacity---Sure?

Do you know positively just how fast it is running—how many feet per minute? If you don't, it's time you got a Cut-Meter and found out. Cut-Meter literature for the asking.



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New York Office—39 Cortlandt St. Boston—143 Federal St.

European Agents—Selig, Sonnenthal & Co., London. Sole Agent for Great Britain—C. W. Burton, Griffiths & Co., London, E. C. Sole Agent for Canada—Fairbanks & Co., Montreal, P.Q.

A STEAM TRAP

to be the best should not only discharge the water from steam systems, but do it immediately; it should also cost the least to install and be the easiest to repair.

THE MARCK STEAM TRAP

meets all of these qualifications. If there are others we have never seen them. If you use steam in any form and for any purpose it will pay you to mention this ad. in writing to us for a Trap Catalog. It shows many ways to and some few ways not to apply a steam trap Please remember there are over a half million of the MARCK STEAM TRAPS in use.

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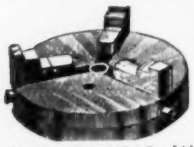
(16)

The Horton Lathe Chuck.

Established 1851....
Send for Illustrated Catalog.



Also Chucks for Brass Finishers' Use, Grinding Machines, Milling Machines, Screw Machines, Upright Drills, Cutting-off Lathes, Drill Lathes, and for Boring Mills, for Car Wheels and Other Work. Also the most complete list of

Improved Independent Reversible Jaw Chucks in the World.

Trade The Horton Lathe Chuck Mark.
NONE GENUINE WITHOUT IT.

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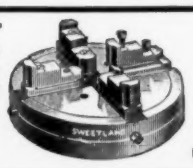
IF YOU WANT THE BEST LATHE & DRILL
CHUCKS
BUY
Westcott's
Strongest Grip, Greatest Capacity and Durability, Cheap and accurate.

WESTCOTT CHUCK CO., Oneida, N.Y., U.S.A.

Ask for catalog in English, French, Spanish or German. First prize at Columbian Exposition, 1893.

EXPANDING MANDREL
Made by WM. G. LeCOUNT, South Norwalk, Conn.
Send for "Catalog A." Full line of Machine Tools.
Agents: Chas. Churchill & Co., Ltd., London, England.

OUR "JULY" CATALOGUE SHOULD BE CONSULTED IF YOU NEED CHUCKS.



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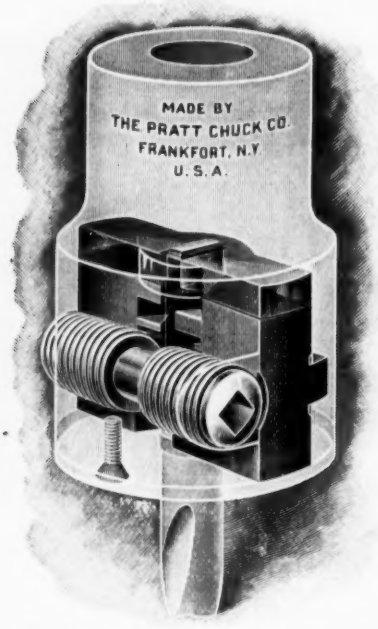
The Skinner "New Model"

Drill Chuck is just the chuck you need for light, rapid drilling. It can be operated by hand. The simple use of a spanner wrench gives a very firm grip. It's a chuck that's easy to clean and oil, because readily taken apart. Send for catalog.

The Skinner Chuck Co.
New Britain, Conn., U.S.A.

Looking Into The Pratt Chuck

we find every detail designed as it should be.



The drill is held so that it can't possibly slip and yet this isn't secured by chewing the shank all to pieces. Let us explain at greater length.

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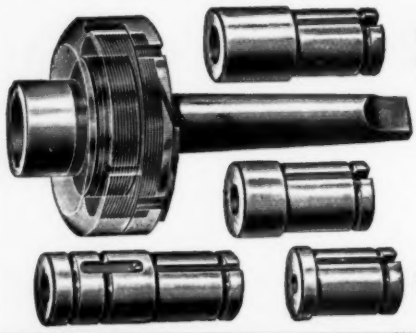

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Safety Drill & Tap Holder

is the only attachment for the purpose that gives universal satisfaction and is

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Efficiency, Convenience, Rapidity, Accuracy and Simplicity.

Nothing to *break* or get out of *order*. Made in 4 sizes, covering from 0 to 2½ in. diameter.

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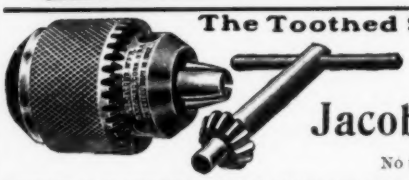
The Toothed Sleeve and Key is the feature



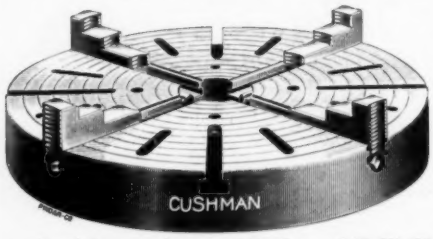
OF THE

Jacobs Improved Drill Chuck

No twisting of spindle when tightening drill.

THE JACOBS MANUFACTURING CO., Hartford, Conn.

"CUSHMAN CHUCKS."



Independent 4-Jaw Chuck, Style 10
Heavy pattern for hard service.
All sizes from 4½" to 30" diam.

We also have Face Plate Jaws for machines requiring something larger.

Send for catalogue of Lathe and Drill Chucks. We have many styles and sizes.

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Right Now

Is the best time to investigate the Reid Chuck. Send for the Book.

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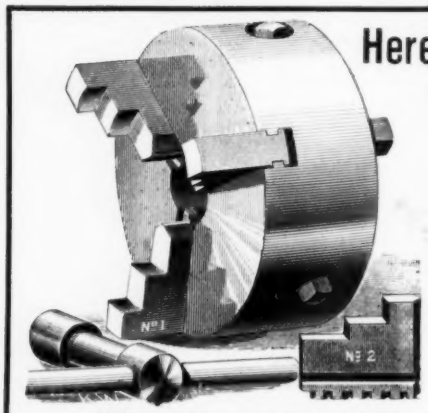

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If you know what broken chucks mean, no more need be said—this one can't break.
Whiton's Chuck Book describes its good features and Whiton will be pleased to send it.

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IMPROVED MACHINERY
FOR
CUTTING AND THREADING PIPE
For Hand or Belt Power
With Steam Engine or Electric Motor Attached

Automatic Machines
for making Wood Screws.
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CRESSON VARIABLE SPEED MECHANISMS.
A device possessing the necessary mechanical qualifications to assure a positive and efficient variable speed drive.
Particularly adaptable for varying the cutting speeds of planers, lathes, boring mills, cylinder boring machines and blowers, either for overhead or motor drives. Equipped with automatic actuating device for operating boring mills.
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cannot twist or untwist like a wire cable, and will revolve in either direction.
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MILLING MACHINES
THE OWEN MACHINE TOOL CO.,
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Advertisement Reader,
MANUFACTURER OF
A MODERN DEVICE.
POLICY: To look into every good new thing.
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You have been making strong claims in your advertisements for Franklin Metal and your process of Die Casting.

You state that it is strong, hard metal which can be substituted, in a great many cases, for other metals used for making small parts for various devices, and that you can Die Cast such parts ready to assemble, thereby saving the cost of machining.

Kindly furnish me with "the proof."

Very truly yours,

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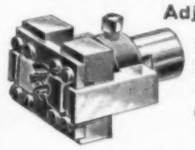
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No. 1 Threads to ⅜ ....⅜"
No. 2 Threads to 1 " ....¾"
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Opens and Closes While Rotating.

AUTO-REVERSE
TAPPING CHUCK.
No. 00 Taps to ⅜ Inch.
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No. 1 " " ¾ "
No. 2 " " 1 "
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Fits any Drill Press.
Drills, Taps Sets Studs, In Line.
The Only Automatic Reverse.
NO { STOPPING, REVERSING, MOVING WORK, CHANGING SPEED.
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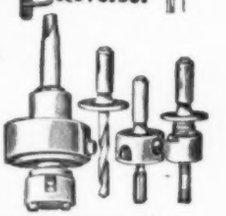
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MAKERS OF
Wallace Patent Chaser Grinders, Wallace Self-Opening Dies, Solid Adjustable Dies, Adjustable Tap and Die Holders, Hollow Milling Tools, "Modern" and "Star" Tapping Attachments, "Magic" Chucks and Special Tools.

FOR PEOPLE WHOSE TIME IS PRECIOUS send unfinished samples We will grind without charge reporting time & material used send to day.

After we've finished the sample piece you are going to send us, we can talk about the installation of one or more Gardner Grinders. While we're finishing the piece it might be well for you to look over the catalog, which very interestingly tells the tale of the Gardner Grinder, and shows wherein it will be a good thing for you to use.

CHARLES A. BESLY & CO. 15-17-19-21 CLINTON ST CHICAGO ILL. U.S.A.

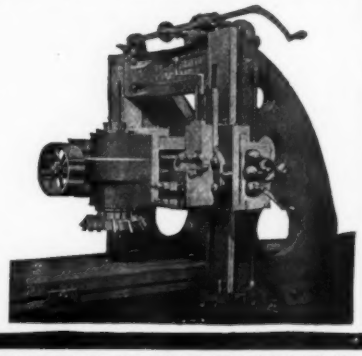
Originators of Disc Grinders

MILLING ON THE PLANER

You have a stationary tool on your planer, why not have a revolving tool, also?

The **Farwell Miller, Built for planers, is a big cost cutter on a lot of that work that is finished all over.**

Vertical, horizontal or angular spindle. Four sizes. We can fit any planer. Send for Catalog No. 55.



THE ADAMS COMPANY,

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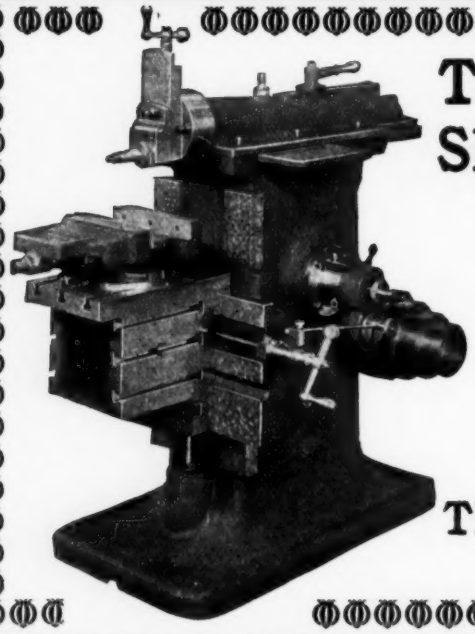

The "Springfield" 16" Crank Shaper Has Eight Speeds,

which allows every metal to be cut at its right cutting speed and, as every part has been built of great strength and rigidity, big cuts and heavy feeds can be taken, thus giving the maximum rate of production.

The traverse feed will take all adjustments from nothing to full, and a down feed of similar capacity can be furnished if desired. The vertical adjustment of the table is 18", and the cross motion is 20".

We have a special circular for you. Ask for it.

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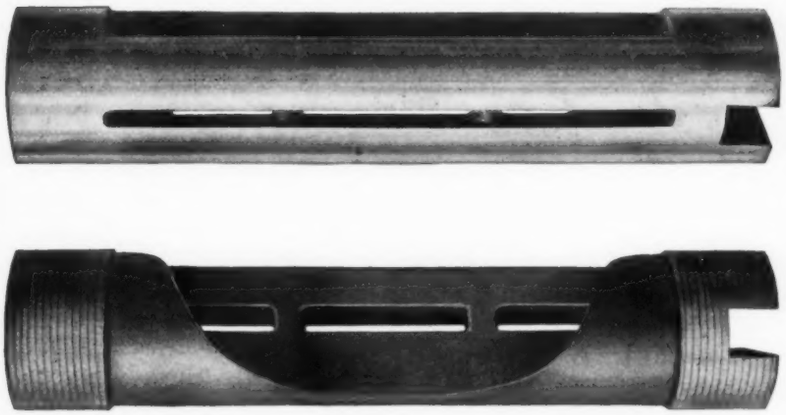

Size: 26″ long, 5½″ diameter.

Turned from rough casting ONE CUT 4 PITCH, reduction in diameter ¼″, TIME 10½ MINUTES.

Ground from above turning in Norton Plain Grinder, reduction in diameter 1-32″, time 30 minutes.

Total time from ROUGH CASTING to FINISHED GROUND VALVE 42 MINUTES.

THINK THIS OVER.

Can you do as well as this with the machines you have?

REMEMBER this is a nice ground surface, not an irregular surface from a broad nose turning tool or a file. Others are using our Grinding Machines in connection with high speed turning.

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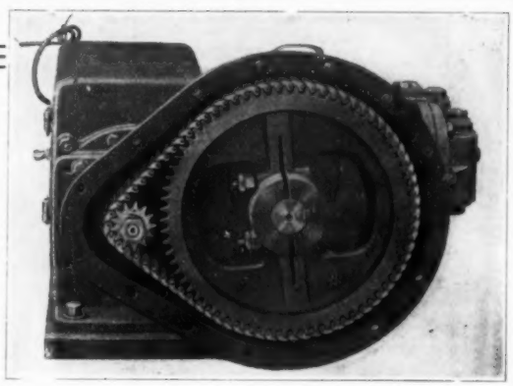
The Opinion of an Expert

is the name of our new folder. It tells how an eminent engineer solved a difficult transmission problem by means of the



Morse Rocker Joint Chain,

after making tests of samples submitted by various chain manufacturers. If you're interested in power transmission, don't forget to ask us for the folder.

Morse Chain Co., Trumansburg, N. Y.

Every Grinder Facility Possible

is embodied in this our "Safety" Emery Wheel Grinder, and that you have use for just such a tool as this there can be no doubt. 'Twill pay to find out about it.

The Safety Emery Wheel Co.,
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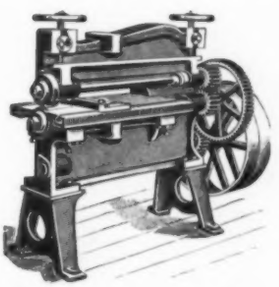
Represented by Pfeil & Co., London. DeFries & Co., Act.-Ges., Berlin Dusseldorf. Adolphe Janssens, Paris, Brussels. V. Lowener, Copenhagen Stockholm. Adler & Eisenschutz, Milan.

For Cutting Sheet Iron and Plates



There's no shear like the Bethlehem Rotary Shear. It does the work accurately and rapidly—no jar, no noise. Cuts straight lines or circular discs, and will slit square holes in centre or away from edge of plates Every shear thoroughly tested before it is sent out. Send for Special Shear Catalog.

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Ready made Cast Gears.
Ready made Brass Gears.
Gears made to order.
Gears Cut on your Blanks.

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WE do that!!
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Special attention to Hurry orders and Break-down jobs.
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A good text book for classes in drawing.
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Gears { of all *kinds* and *sizes* in stock and made toorder.
From—the cheapest that's *good*
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Accurately Cut Gears.
If that's wnat you want
send your specifications to
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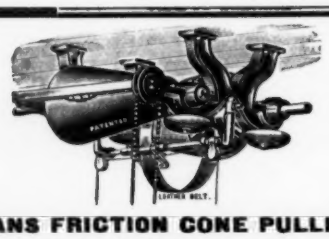

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Changing Speed of Machine while Running.
Send for Catalogue.
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WE MAKE A FULL LINE OF AUTOMATIC GEAR CUTTING MACHINES.
MACHINES FOR GENERATING WORM WHEELS
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MACHINES FOR GENERATING SPUR GEARS
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METAL GEARS How do they feel about it? NEW PROCESS RAW-HIDE PINIONS

Don't you find it annoying to good men to endure the constant din of metal gearing?
Workmen find it a pleasure to work in shops where New Process Pinions are used. Made of raw hide, they deaden the sound, yet provide a positive drive, and wear like iron.
Write for free booklet to-day. We also make accurate Metal Gears.
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MORRIS & WALES, PHILA.

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Rawhide Belting, Lacing=Rope

2,000 and More Styles
we make regularly in Gears (patterns always in stock) but if the kind you want isn't among 'em, we can make it for you if you'll tell us what you want. The Gear will be right and so will the price. Truck wheels, too. Catalog?
I. & E. Greenwald Co.,
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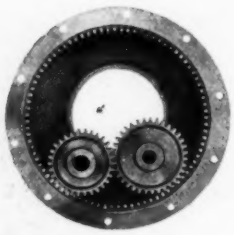
When the Demand



for a product necessitates the constant addition of machinery, the natural inference is that the superiority of the product is universally recognized—referring to Nuttall Cut or Planed Gears.

R. D. Nuttall Co.
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MACHINE MOLDED GEARS

Made right from right materials. Made accurately and made to last. Made as a specialty and in every kind and size

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Gears are correctly cut on the Fellows Gear Shaper only. No rotary cutter will cut them in the practical way that makes them profitable. The reasons are ready whenever you choose to ask for them.

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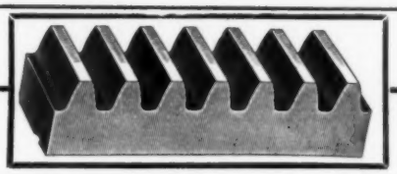

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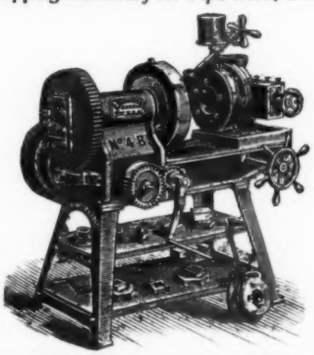

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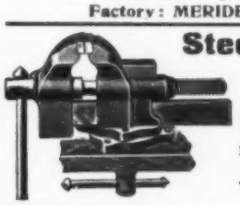

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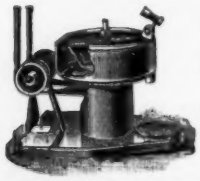

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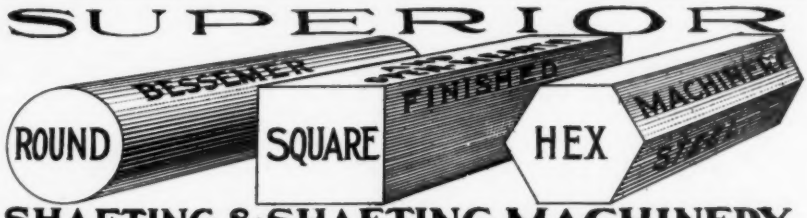

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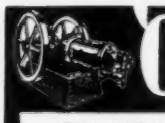

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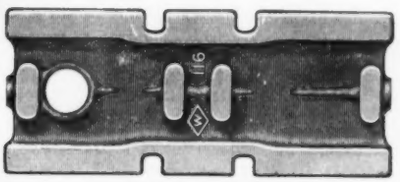

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Starts a machine as easy as rolling a ball down hill.

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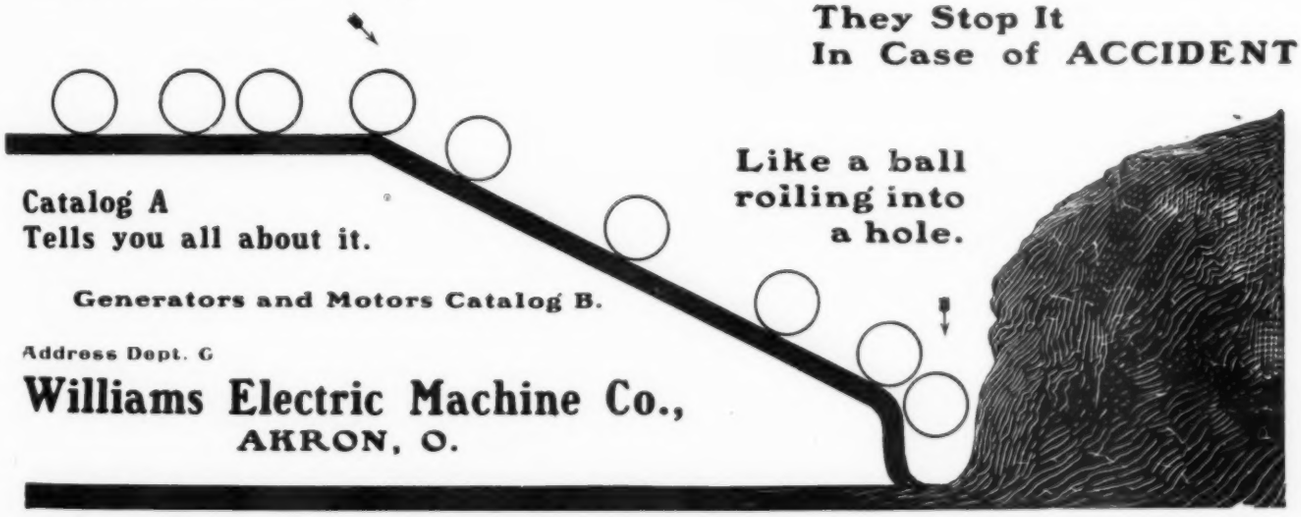

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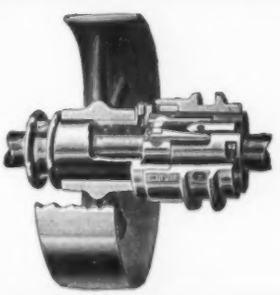
Has an absolutely smooth surface, operates easily and quietly, and works perfectly at any speed.



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PUMPS

2—7 x 4½ x 10 Laidlaw-Dunn Boiler Feeders for 150 lbs. pressure.

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3—250 H.-P. Ball Tandem Compound Engines, 15″ x 25″ x 16″, 200 revolutions.
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1—125 H.-P. Hamilton Corliss, 16″ x 30″, 90 revolutions.

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3—150 K. W. 250-volt Westinghouse Generators. These generators directly connected to three 250 Ball engines.
4—42.5 K. W. 125-volt Mather Generators.
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2—Switchboards with switches, measuring instruments, rheostats, etc., for control of above generators.

Another plant, complete except boilers, consisting of the following principal items:

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2—Lane & Bodley Corliss Engines, 24″ diameter cylinders, 48″ stroke, 70 rev.
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10—100-light, 9.6-ampere Multiple Circuit Brush Arc Machines.
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Switchboard with all switches, transformers, measuring instruments, etc., for control of above generators.

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BULLDOZERS AND DROP HAMMERS.
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300 lb. Pratt & Whitney Board Drop.
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31″ x 16′ Le Blond, latest pattern.
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17″ x 8′ Le Blond, comp. rest and taper.
50—14″ Lathes.

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11′ Niles, double head.
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2¾″ bar Bement-Miles Horizontal, 8′ table.
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8′ square Niles, 4 heads, modern.
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6—Heavy Slab Millers, large tables.
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PRICES THAT'LL MAKE
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WE WANT THE ROOM
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7-10 ft. Betts, 1 head.
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PULLEY LATHE, 50 in., double tool. "Niles."
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2—Potter & Johnston Full Automatic Chucking Lathes with full assortment of tools; offered at $1,200 for the two, subject to prior sale.

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24" x 26' Fifield, compound rest.
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42" Warren, swiveling arm.

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2½" Pratt & Whitney Cutting-off Machine.
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16 in. x 8 ft. Pratt & W.
18 in. x 8 ft. R. & F. Lodge & D.
18 in. x 8 ft. R. & F. Pratt & W.
19 in. x 7 ft. Pl.Swiv. Pratt & W.
19 in. x 12 ft. Pratt & W.
20 in. x 9 ft. Pratt & W.
22 in. x 8 ft. Plain, Niles
28 in. x 8 ft. Comp., Pond.
26 in. x 12 ft. C. R. Fitchburg
32 in. x 13 ft. 6 in. C. R., Pond
42 in. x 18 ft. C. R. & T. Niles T. W.
26 in. Pulley Lathe
42 in. Pulley Lathe
14 in. Chucking Lathe
16 in. Chucking Lathe
18 in. Chucking Lathe
26 in. Chucking Lathe.
20 ft. Pit Lathe
35 ft. Pit Lathe
Bement Axle Lathe.
24 in. American Turret Lathe

Planers

18 in. x 16 in. x 3 ft. Lathe-Morse
26 in. x 26 in. x 6 ft Flather
26 in. x 26 in. x 8 ft. New Haven
30 in. x 30 in. 8 ft. Fitchburg
38 in. x 42 in. x 14 ft., 4 heads, Pond
48 in. x 48 in. x 18 ft., 2 heads, Niles.
62 in. x 60 in. x 18 ft., 2 heads, Bement.
78 in. x 72 in. x 24 in., 3 heads, Bement

Shapers

9 in. Traverse head, Sellers
16 in. Milwaukee Shaper
24 inch Smith & Mills

Screw Machines

No. 1 Garvin
No. 2 Pratt & W.
No. 12 Garvin
No. 3 Pratt & W.
No. 2 Niles
No. 3 Garvin
No. 1 Auto. Pratt & W.

Drills

12 in. Sensitive, Herrick & Co.
2-Sp. Bicycle Rim Drill, Fox
11 in. 3-Sp. Sigourney
14 in. 3-Sp. Hendey
16 in. 3-Sp. Adj., Foote, B. & Co.
17 in. 4-Sp. Pratt & W.
17 in. 4-Sp. Jones & Lamson
24 in. Cincinnati, with tap. att.
24 in. Blaisdell, sliding head.
32 in. Pond, sliding head
42 in. Putnam
6 ft. 10 in. No. 2 Radial, Niles
10 in. 3-Sp. Adj. Foote B. & Co.
17 in. 4-Sp. Pratt & W.
17 in. 4-Sp. Jones & Lamson
16 in. 6-Sp. Quint
16-Sp. Car Wheel Drill, Niles
Hoefer Horizontal Drill

Milling Machines

Bench Hand Miller
No. 1 Garvin Hand Miller
No. 1 Plain, Pratt & W.
No. 2 Plain, Garvin
Ames Hand Miller
Ames Lincoln Miller
No. 2 Lincoln Miller, Pratt & W.
No. 3 Lincoln Miller, Pratt & W.
Brainard Index Miller
No. 1 Brown & Sharpe Universal
No. 2 Universal, LeBlond
No. 2 Plain, Kempsmith
No. 4 Vertical, Pratt & W.
Garvin Profiler
No. 6 Vertical, Niles
Duplex Miller, Niles

Boring Machines

Horiz. Boring Hd, Nich'son & W.
No. 3-B, 5 ft. table, Binsse
No. 2, 6 ft. table, Bement
28 in. x 12 ft. Horizontal, Sellers
32 in. x13 ft. 6 in. Hor. Pr't & W.
No. 1, Loco. Cyl., Newton
50 in. x 18 ft. Horizontal, Sellers
60 in. x 12 ft. Horizontal, Pond
50 in. Pulley Borer, Niles
14 ft. Borer & Turning Mill, Niles

Grinding Machines

No. 1 Tool Grinder, Brown & S.
Walker Cutter & Reamer Grinder
7 in. x 15 in. Univ. Grinder Brown & Sharpe
8 in. x 16 in. Univ. Grinder, Diamond
16 in. x 66 in. No. 4-A Univ. Grinder, Landis
12 in. x 2 in. Wet Tool Grinder, Blount
24 in. x 42 in. Wet Tool Grinder, Barnes

Miscellaneous

Hydraulic Riveter and Crane, 1 in. cap. rivets, pressure 35 gross tons, gap 8 ft.
No. 1 Newton Cold Saw
⅜ in. Shuster Riveter

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BAIRD'S REFITTED AND UP-TO-DATE SECOND-HAND TOOLS.

MILLING MACHINES.

2035—22 in. x 5 ft. Ingersoll.
2036—22 in. x 5 ft. Ingersoll.
1008—Davis & Egan, No. 2 Univ.
1888—Garvin & Co., No. 2 plain.
1697—No. 11 B. & S., plain.
1864—Amer. Tool Works, hand miller.
1687—2 Spindle Valve Miller.

PRESSES.

1880—Bliss, No. 61 Reducing.
2024—1⅝ in. Stroke, Stiles, No. 2½ Power Press.
1909—100 Ton Hyd. Press, Watson-Stillman.
1893—No. 6 Long & Allst. Punch.

LATHES.

1837—9 in. x 4 ft., 6 in. Star.
1937—13 x 6 Ames.
1540—14 x 4 Lathe & Morse Plain Turning Lathe.
1836—14 in. x 5 ft., 6 in. Lathe.
2000—14 in. x 6 ft. Prentice.
1280—21 in. x 6 ft. Ames.
1997—24 in. x 10 ft. Perkins.
2002—24 in. x 12 ft. New Haven.
2018—16 in. Hollow Hex. Turret Lathe, Warner & Swasey.
1538—14 in. x 5 ft. Pratt & Whitney Turret Lathe.

SHAPERS.

1611—10 in. New Haven Crank.
1401—12 in. Traverse Head.
2031—15 in. Steptoe & Co.
2023—15 in. Steptoe & Co.
2024—15 in. Smith & Mills.
2022—24 in. Gould & Eberhardt.

PLANERS.

2033—25 x 25 x 5 ft. 6 in. Sellers.
1040—26 x 26 x 6 ft. Cincinnati.
102H—26 x 26 x 11 ft. Flather.
2034—30 x 33¼ x 8 ft. Pond.
1735—36 x 36 x 10 ft. Sellers.
2007—36 x 36 x 10 ft. A. & E. Betts.
1807—38 x 38 x 16 ft. Hewes & Phillips.

SCREW MACHINES.

1361—16 in. x 5 ft. Jones & Lam.
1743—16 in. x 5 ft. Jones & Lam.

DRILLS.

1899—5 ft. Alfred Box Radial.
1397—4 ft. 6 in. Heavy Radial.
1994—4 ft. Hilles & Jones Radial.
1886—12 in. Sensitive Drill.
1993—25 in. Upright Drill.
1944—14 in. Worcester Sliding-head.
1995—26 in. Upright Drill.
1913—Fulley Hub Drill.
1036—No. 1 Garvin 2 Spindle.

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THE JEFFREY MANUFACTURING CO., COLUMBUS, OHIO, U.S.A.

BARGAINS
—IN—
2ND HAND MACHINERY.

LATHES.

46 x 14' New Haven, triple geared, C. R. and P. C. F.
30" x 14' Betts, plain gib rest.
29" x 12' Davis, R. & F. rest.
26" x 22' Betts, shafting, C. R.
2o x 20' Chamberlain, shafting.
24" x 12' Fifield, C. R. and P. C. F.
22" x 21' Wheeler, shafting.
18" x 8' Flather, plain gib rest.
17" x 8' Pratt & Whitney, plain gib rest.
16" x 5' Pratt & Whitney, taper attachment.
16" x 6' Le Blond, C. R.
15" x 8' Reed, plain gib rest and chuck.
26" x 10' Prentiss, C. R.
14" x 6' Lodge & Shipley, comp. rest.
50-66" x 28' Farrel, trip. grd.
24" x 11' Bullard, trip. grd., frict. hd.
62" Niles, double hd. driving wheel with quartering attachment.

BORING MACHINES.

B. & S. duplex.
No. 2 Barrett cylinder.
42" Bement wheel borer.

SCREW MACHINES.

No. 2½ P. & W., 1½" wire feed cap.
Four, Garvins, miscellaneous sizes.
No. 1 W. & S., wire feed, with pump and chuck.
No. 1 P. & W., wire feed.
No. 2 Garvin, wire feed, 6" box body chuck.

PLANERS.

60" x 60" x 20' Fitchburg.
30" x 30" x 10' Putnam, 1 head.
24" x 24" x 5' Sellers.
37" x 37" x 12' Sellers.
26" x 26" x 6' Flather, 1 head.
24" x 24" x 7' New Haven, 1 head.
20" x 20" x 5' Hendey.

SHAPERS.

16" Prentiss.
18" Putnam friction.
18" Wright friction.

MILLING MACHINES.

No. 2 Owen B. G. univ., all att.
3 No. 1 B. & S. plain.
No. 5 B. & S. plain.
No. 4 Garvin plain.
No. 2 Becker vertical, rotary attach.
2 spd. Am. T. & Mch. valve.
No. 2 Cincinnati univ.
No. 2 Cincinnati plain.
8 Phoenix, Lincoln pattern.
2 Cook, Lincoln pattern.
2 P. & W., Lincoln pattern.
3 Lamson & Goodnow, Lincoln pattern.

DRILLS.

No. 2 Bickford, old style, 5' arm.
25" Barnes upright, B. G. & P. F.
38" New Haven upright, B. G. & P. F.
6 spindle Hendey multiple.
8 spindle Gardam multiple.

GRINDERS.

No. 2 Landis universal.
No. 1 B. & S. universal.
Warner & Swasey cock ginder.
Walker cutter and reamer grinder.
No. 1 Woodward & Rogers surface, fine order.

MISCELLANEOUS.

12" Betts crank slotter, fine.
18" Putnam slotter, fine order.
No. 5½ Bliss double crank press, B. G.
No. 4 B. & S. automatic gear cutter, to cut spurs 36" diameter, with pump and regular attachments.
No. 5 B. & S. automatic gear cutter, to cut spurs 48" diameter, with pump and regular attachments, in fine order.
¾" Burdict bolt header.
24 x 8" automatic gear cutter.
2 spd. P. & W. profiler.
1 spd. Garvin profiler.
Friction board lift drop hammer.
25 power presses, ass't sizes.
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1—Blaisdell lathe, 24″ x 10′, with taper.
1—Blaisdell lathe, 36″ x 12′, swings 42″.
1—New Haven lathe, 28″ x 13′.
1—Fay & Scott lathe, 32″ x 18′.
1—Flather planer, 26″ x 26″ x 6′.
1—Pond planer, 36″ x 36″ x 10′.
1—Powell planer, 36″ x 36″ x 10′.
1—Pond planer, 38″ x 38″ x 12′, 2 heads.
1—New Haven planer, 40″ x 40″ x 10′.
1—Pond planer, 78″ x 72″ x 20′.
1—No. 1 Precision boring machine.
1—No. 0 Turret brass lathe, 26″ swing, made by the American Tool & Machine Co. In fine condition. Great bargain.
1—No. 1 Brainard Miller, table 50″ long, self-feed 36″, with 16″ gear cutting device. In excellent condition.
1—B. & S. 18″ automatic gear cutter.
1—No. 5 Bardons & Oliver Screw Machine.

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27 x 27 x 6 Ohio Machine Co.'s Planer.
32″ Gould & Eberhardt Drill, back geared and power feed.

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BORING MILLS.
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1—80″ Sellers, single head.
1—37″ Bullard, double head.
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2—No. 0 Bickord Radial.
1—No. 2 Bickford Radial. 4—22″ Post.

PUNCH PRESSES.
No. 7 Long & Allstatter, double head.
No. 6 Long & Allstatter, single head.

BRADLEY HAMMERS.
4—25 lb. Helve Hammers.
1—40 lb. Helve Hammer.

ENGINE LATHES.
16″ x 6′ Lodge & Shipley, compound rest.
28″ x 24′ New Haven, compound rest.
22″ x 8′ Blaisdell, compound rest.

MILLING MACHINES.
1—No. 21 Garvin.
4—No. 3 Garvin, plain.
6—No. 1 Garvin, plain.
3—Pratt & Whitney, Lincoln pattern.
1—24″ x 24″ x 10′ Ingersoll Slab, motor driven.

PLANERS.
36″ x 36″ x 12′ Detrick & Harvey, 3 heads.
18″ Crank Planer.
48″ x 60″ x 18′ Gleason, 2 heads.

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Engine Lathes.

12 in. x 6 ft. Prentice, rise and fall rest.
13 in. x 6 ft. Blaisdell, rise and fall rest.
13 in. x 6 ft. Pratt & Whitney, rise and fall rest.
14 in. x 5 ft. Lodge & Shipley, rise and fall rest.
14 in. x 6 ft. Smith, plain rest.
16 in. x 6 ft. McMahon & Carver, plain rest.
16 in. x 6 ft. Ames, plain rest.
16 in. x 6 ft. Springfield, compound rest, quick change gear.
18 in. x 6 ft. Jones & Lamson, rise and fall rest.
18 in. x 6½ ft. New Haven, rise and fall rest, 13 in. chuck.
18 in. x 6 ft. Perkins, rise and fall rest.
18 in. x 8½ ft. New Haven, compound rest.
21 in. x 10 ft. New Haven, compound rest.
21 in. x 13 ft. Lodge & Davis, compound and taper.
21 in. x 8 ft. Blaisdell, plain rest with chuck.
20 in. x 13 ft. Ames, plain rest.
21 in. x 8¾ ft. New Haven, compound rest.
21 in. x 10 ft. Perkins, plain rest.
24 in. x 12 ft. New Haven, compound rest.
28 in. x 13 ft. New Haven, compound rest.

Special Lathes.

84 in. Pit, double back geared.
15 in. Prybil Spinning Lathe.
31 in. Buckeye Chucking Lathe.
14 in. x 11 ft. Axle Lathe.
12 in. x 12 ft. Bed Stud Lathe.
11 in. x 38 in. Back Geared Stud Lathe.
24 in. x 14 ft. Reed Special Turning Lathe, with two tool posts.
9½ in. x 40 in. Red, Brown & Sharpe Polishing and Finishing Lathe.
17 in. Back Geared Head Stock, with tail stock mounted on iron column with solid iron base, giving 38 in. swing, 72 in. between centers.
48 in. Double Geared, Double Tool Post Pulley Lathe.

Shapers.

6 in. Crank, Boynton & Plummer.
12 in. Crank, back gear, Lowell.
18 in. Ohio Crank Shaper, single geared.
22 in. Ohio Crank Shaper, single geared.
14 in. Steptoe Crank Shaper.
15 in. Hendey Shaper.
22 in. Walcott.
24 in. Hendey.
18 in. Traverse Head, N. Y. S. E. Co.

Pipe Machines.

1 in. to 6 in. Merrell, hand and power.
No. 30 Curtis & Curtis, ⅛ in. to 2 in., for hand only.
No. 1 Apex, ¼ in. to 2 in., Merrell.

Milling Machines.

No. 3 Garvin, with vise and vertical fixture, without arm.
No. 1 Lodge & Davis, Back Geared, plain with overhanging arm.
No. 2 Kempsmith, plain with overhanging arm.

Milling Machines—Continued.

No. 1 Plain with overhanging arm, table 40 in. x 10½ in., power feed 22⅝ in., adj. to column 2 in., vertical 12½ in. greatest swing 14½ in.
Bench Milling Machine, geared, hand and power, with automatic trip, vertical adj. above vise 2⅝ in., bench space 16 in. x 24 in.

Planers.

10 in. x 10 in. x 30 in. Federal, with chuck and centers.
20 in. x 20 in. x 5 ft. Newton, single head.
20 in. x 16 in. x 3 ft. New Haven, single head.
22 in. x 22 in. x 5 ft. Powell, with single head.
24 in. x 24 in. x 5 ft. New Haven, with single head.
28 in. x 28 in. x 6 ft. New Haven, single head.
26 in. x 26 in. x 8 ft. New Haven, single head.
33 in. x 33 in. x 10ft. Cincinnati, single head.
48 in. widened to 72 in. x 52 in. x 20 ft. Betts.
48 in. x 48 in. x 12 ft. Pond, three heads.
36 in. widened to 42 in. x 36 in. x 11 ft. 6 in. Sellers.
14 ft. 6½ in. Boiler Plate Planer, Sellers.

Boring Mills.

60 in. Niles Single head, home-made facing attachment.
53 in. Double Head, King.
64 in. Double Head, King.
76 in. Double Head, King.
30 in. Baush, with turret.

Brass Finishers' Machinery.

2-spindle Valve Milling Machine, Bardons & Oliver.
Warner & Swasey Cock Grinders on legs.
13 in. x 5 ft. Speed Lathe.
13 in. x 4 ft. 6 in. Speed Lathe, dovetail set-over, with two motions to spindle, American.
15 in. x 6 ft. Speed Lathe, back geared, hand rest.
13 in. x 5 ft. Fox Monitor Lathe, back geared, Johnson.
15 in. x 5 ft. Buckeye Turret Lathe, 12 in. box body chuck.
No. 1 Fox Universal Turret Lathe, B. G., American.

Hammers.

No. 3 Bell Standard 700 lbs., Steam.
1250 lbs. Sellers, Steam.
No. 00 Poppet Drop Hammer, weight of head 50 lbs.
1000 lbs. Merrill Automatic Board, Lift Drop.
Foot Power Hammer, bed 6 in. x 6 in.

Drills.

10 in. Friction on column, Stover.
2 spindle, 12 in. vertical, spindles adjustable with chucks, Foote, Burt & Co.
Dallett Portable Drill, No. 4 taper to spindle.
Harrington Suspension Drill.
9 in. Cross & Speirs, three spindle with chucks.
2½ arm Fosdick Radial, plain.
20 in. Prentice, square base, wheel and lever.
32 in. Back Geared, sliding head, power feed, Cin.
36 in. Sliding Head, back geared, power feed, Snyder.
15 in. Bench on legs, travel of spindle 1⅝ in.

Screw Machines and Turret Lathes.

⅝ in. Cleveland Automatic Screw Machine.
⅝ in. Cleveland Automatic Screw Machine.
2 in. Cleveland Automatic Screw Machine.
14 in. Garvin, 2 in. spindle, 1 9-16 in. wire feed.
12 in. swing, ⅝ in. hollow spindle with turret, pilot feed.
13 in. swing, ⅝ in. hollow spindle with turret, lever feed and chuck.
14 in. swing, 1 in. hollow spindle with turret, pilot wheel and chuck, Pratt & Whitney.
16 in., 1¼ in. hollow spindle, double cut off, automatic turret, Warner & Swasey.

Miscellaneous.

Special Screw Slotter, detail on application.
Garvin Nut Tapper.
Elmore Hand Rock Drill.
Garvin Screw Slotter, with power feed.
125 ton Hydraulic Wheel Press, Schaffer.
2 in. Cutting Off Machine, Pratt & Whitney.
Horizontal Keyseater, two rams, 30 in. adjustment.
No. 4 Pox Multiple Tube Cu ter, on iron legs.
Crank Pin Turning Machine, Vogel patent.
36 in. Gould & Eberhardt Gear Cutter, semi-automatic.
Roller Tube Cutter, on column.
4 in. Cutting-Off Machine, accelerated speed.
Pratt & Whitney Duplex Index Centers, 7 in. swing.
One lot Planer Jacks.
¾ in. Dayton Swaging Machine, Excelsior Needle Co.
Goodyear Swaging Machine, capacity 4½ in.
28 in. Fox Wheel Truing Machine.
Power Marking Machine, 1¾ in. plunger.
Spoke Threading Machine, on table.
No. 1 Baker Bros. Keyseater, with rack cutting attachment.
Bench Centering Machine.
Post Crank, suitable for 8 in. x 8 in. post, arm 11 ft. 6 in. long, with travel.
Dwight Slate Marking Machine, No. 2.
9 in. Bement Slotting Machine.
44 in. Car Wheel Borer, with 36 in. chuck, Dorner & Dutton.
Set Rolls, 22 in. between housing, with clutch.
Boiler Plate Rolls, 8 ft. between housing, Bertman.
Broaching Machine, for bicycle cranks.
No. 4 Adams, 1½ in. Double Head Bolt Cutter.
Lot Bicycle Filing Vises.
Bar Shear, K Type, 1¾ in. square, 1 x 5 flat, 1½ in. round.
53 in. Squaring Shear, foot power, Niagara.
Hand Power Shear, 104 in., 48 in. wheel, gears 12 and 64 teeth.
Geared Bench Power Press, ¼ in. stroke, 4 in. throat, bed to slide when up 2¾ in.
No. 3 Stiles Plain Power Press, Bliss.
Foot Press, base 25 in. x 11 in., 14 in. throat, on wood frame.
Boring Bar, 3 7-16 in. diameter, 12 ft., 6 in. long.
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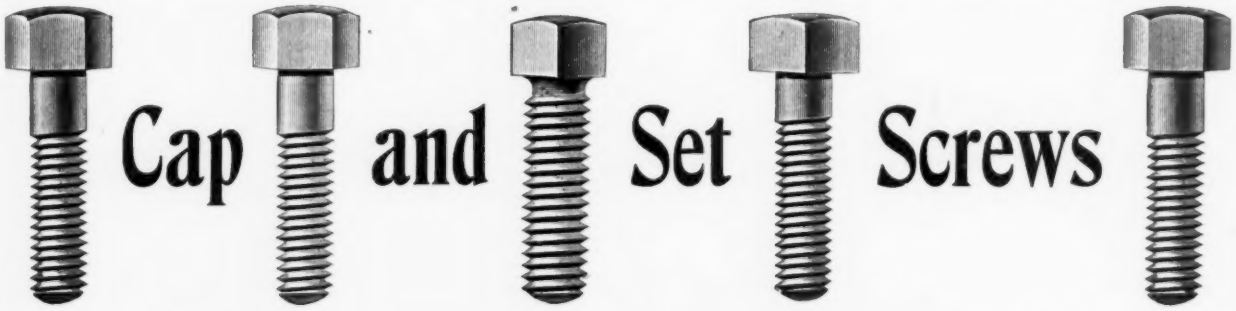

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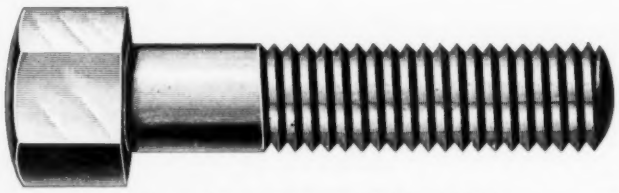
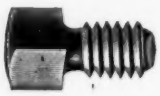


Cleveland, Ohio, U. S. A.



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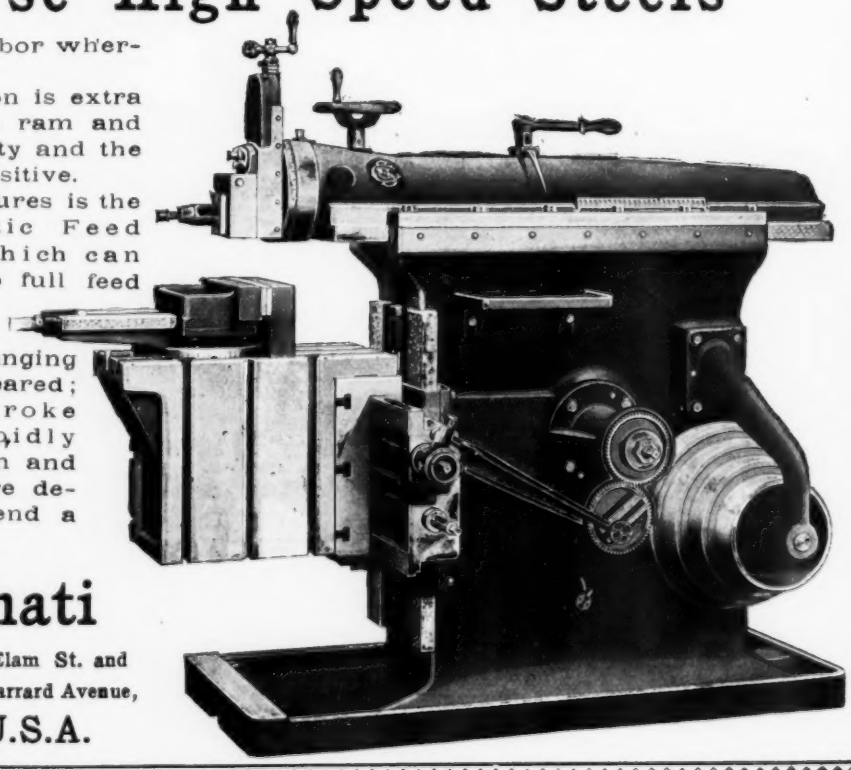
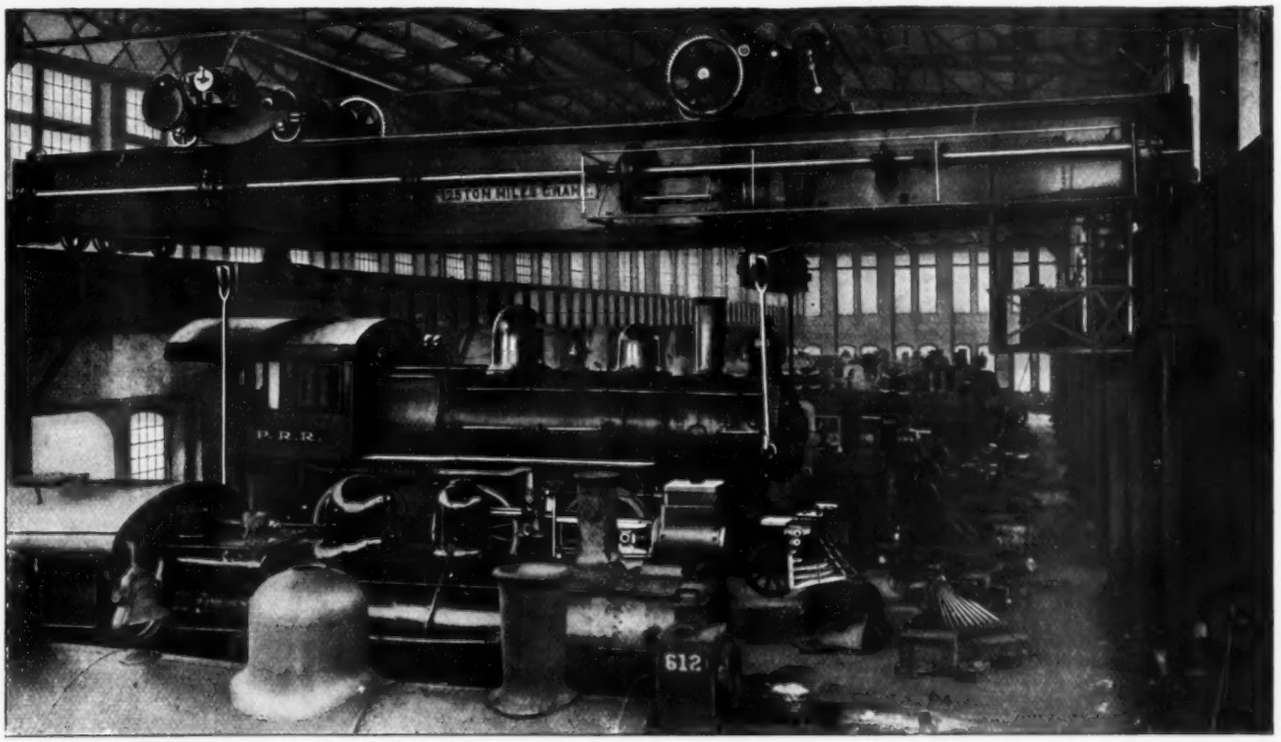


The Cincinnati Shaper Co., Elam St. and Garrard Avenue, Cincinnati, Ohio, U.S.A.



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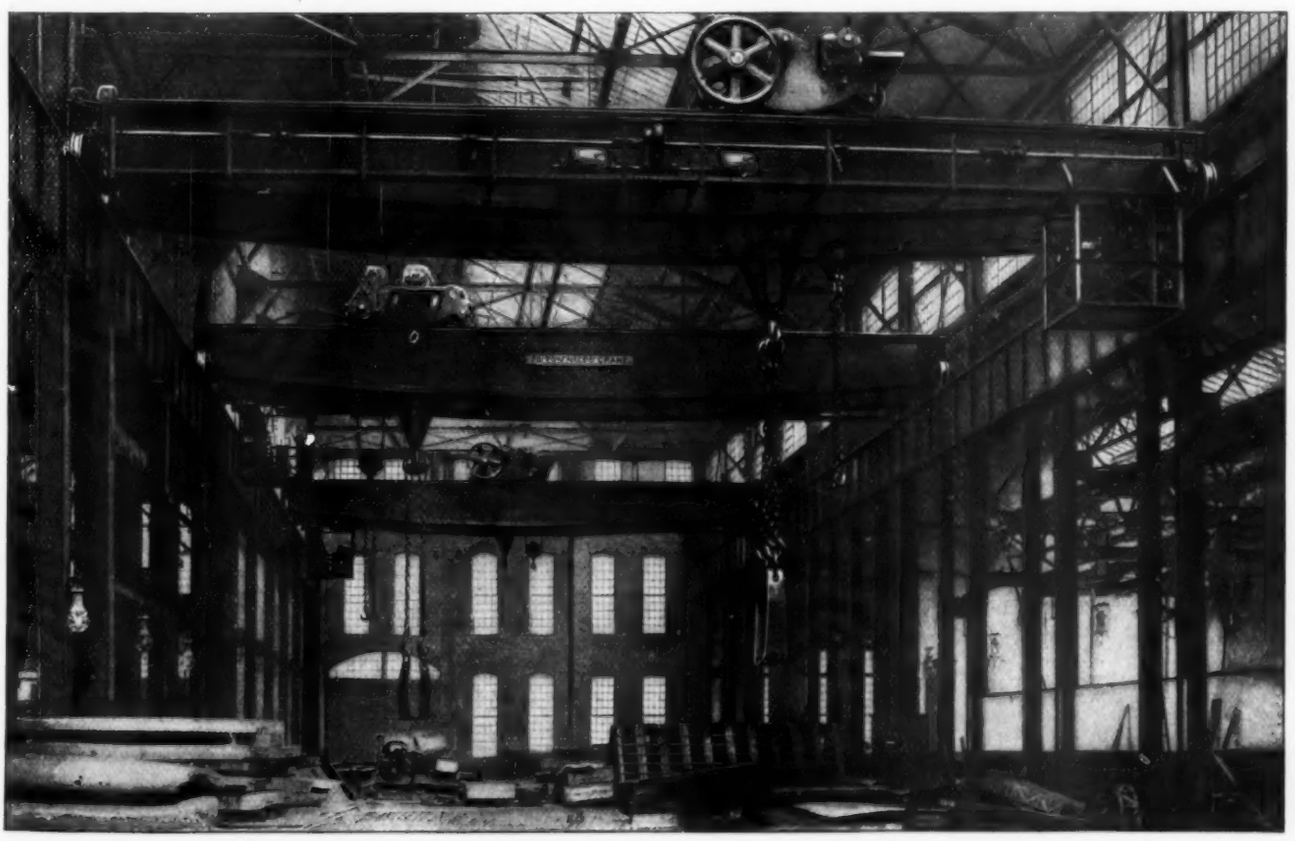
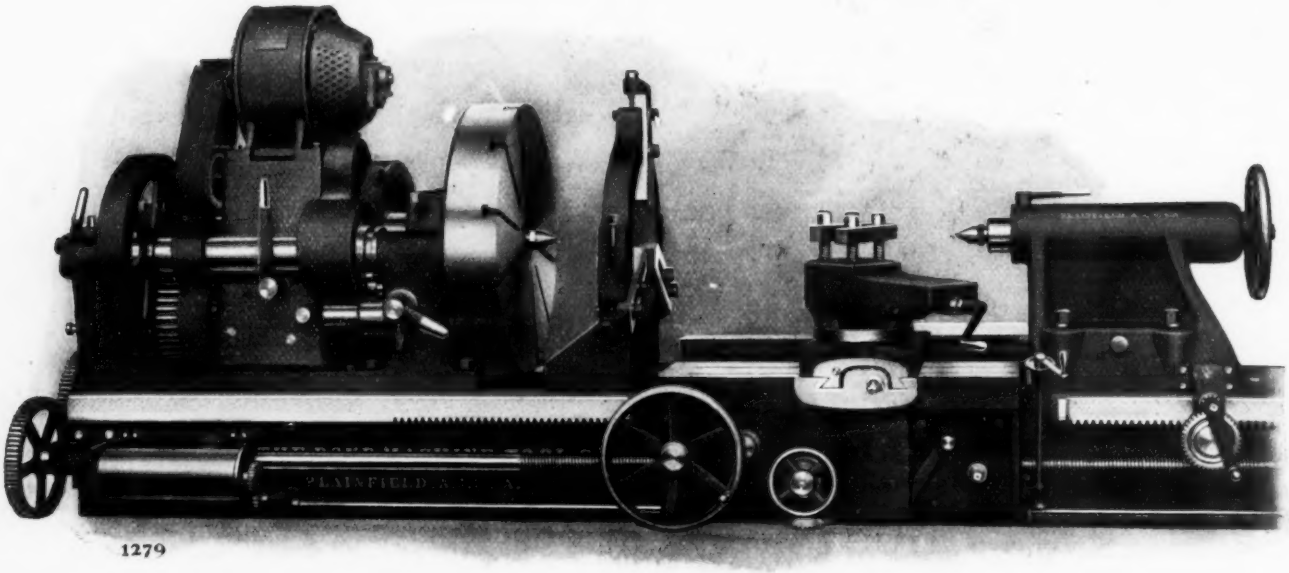


Three 75 Ton Niles Cranes, 60 ft. Span, with 20 Ton Auxiliary Hoists. Carnegie Steel Co., Homestead, Pa.

HEAVY POND LATHES.

AWARDED GRAND PRIZE, LOUISIANA PURCHASE EXPOSITION



1279

42-inch Pond Lathe for use with modern high-power tool-steels.

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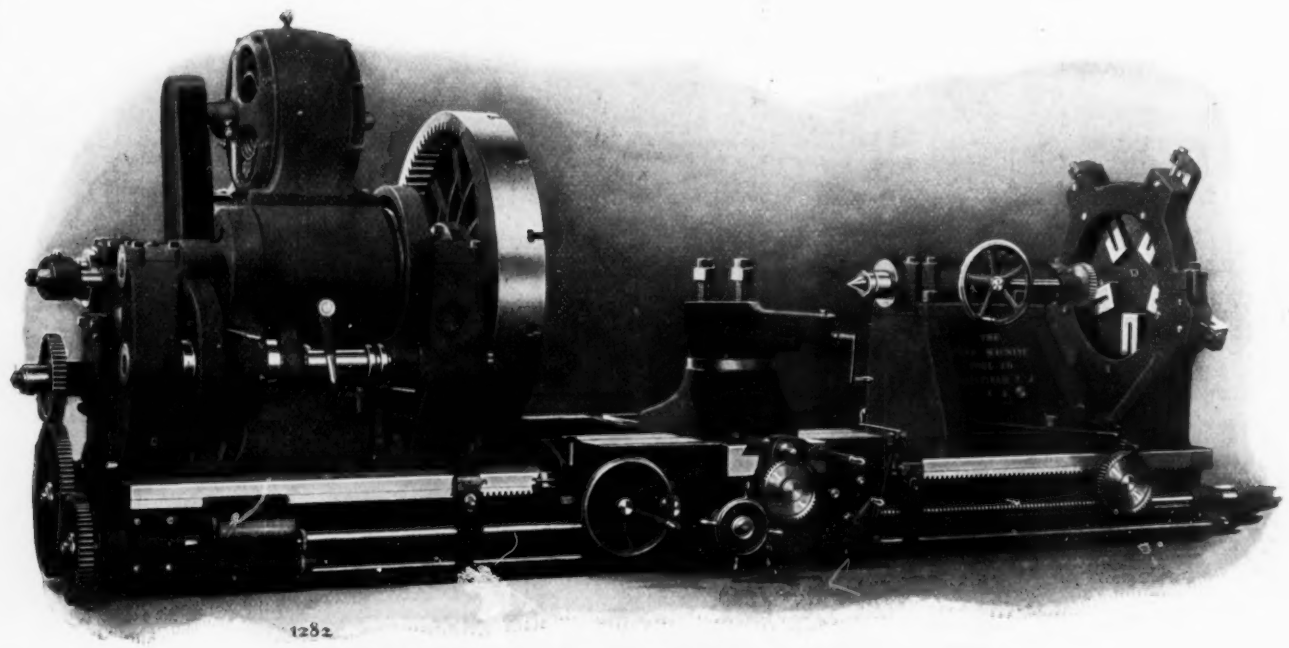

1282

72-inch Pond Lathe for use with modern high-power tool-steels.

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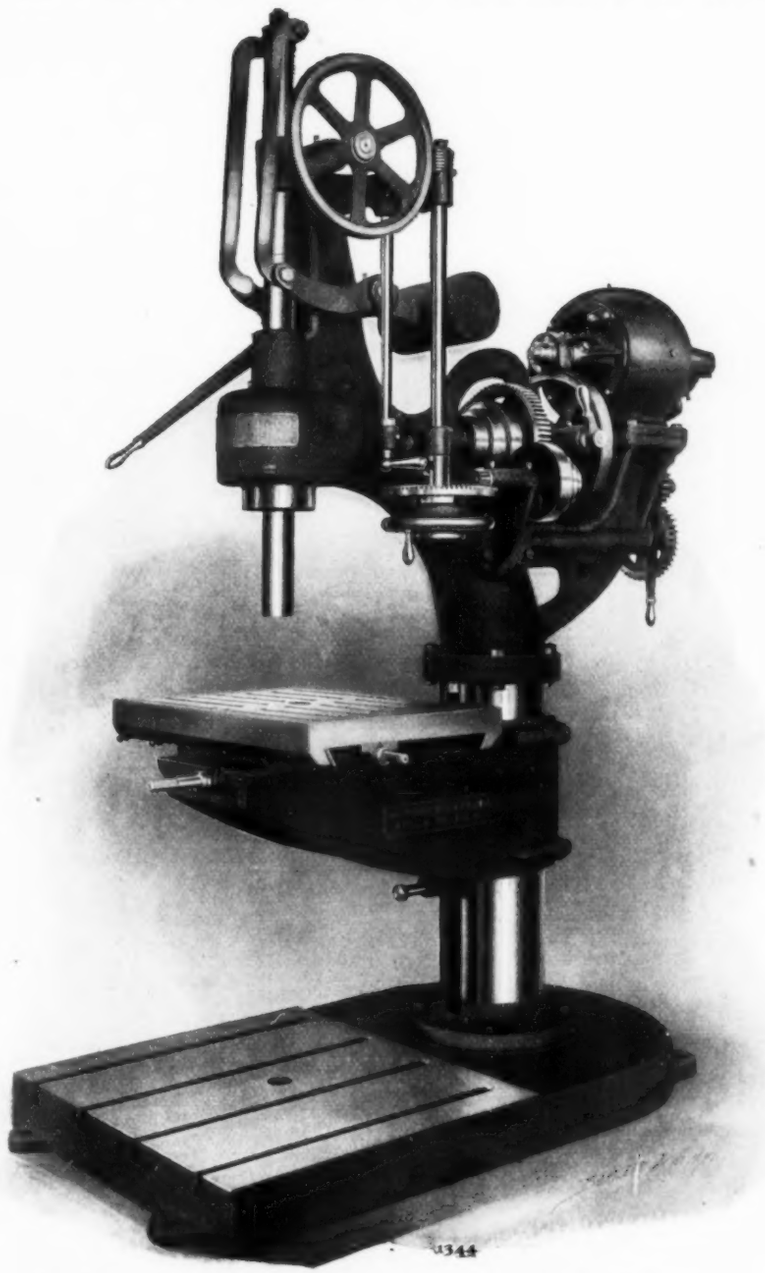
Vertical, Plain and Universal Radial, Swinging Drills, Adjustable Multi-Spindle, Multiple, Rail, Locomotive Frame, Arch Bar, Tube and Gun Barrel, Rifling, etc.



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Twenty-five Sizes, from 30″ to 30′ Swing.

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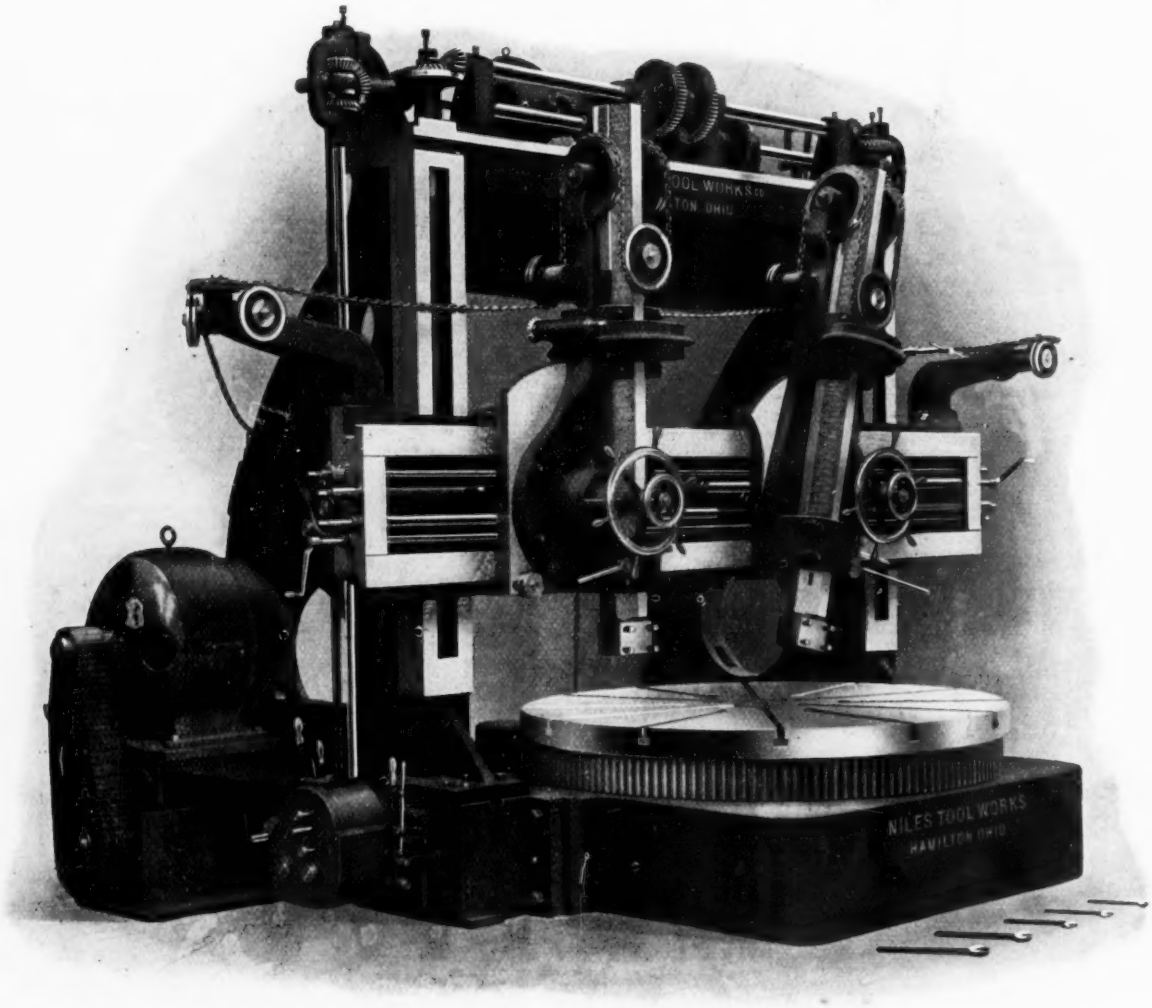

Extra Heavy 10-Foot Boring and Turning Mill.

Nested Gear feeds to bars independent in rate and direction.
For use with modern high-power tool steels.

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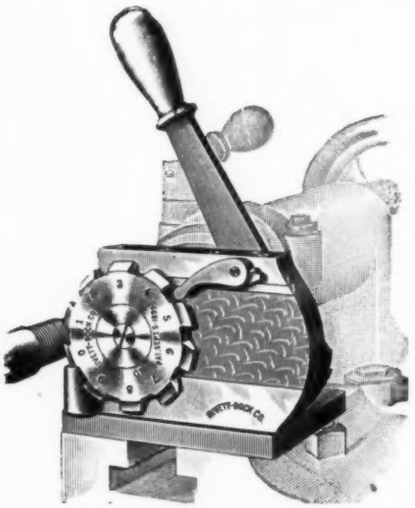
There Isn't One Single Good Reason Why You Shouldn't Use The Rivett-Dock Thread Tool On Threading Work---Not One.



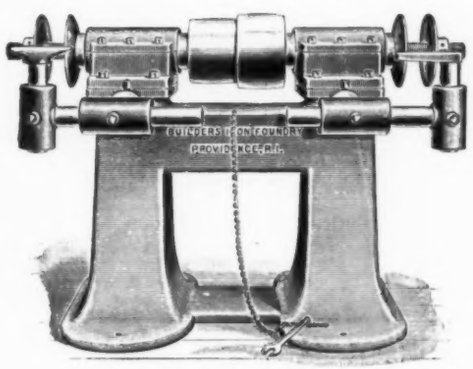
The Rivett-Dock Thread Tool will turn out work in from a third to a tenth of the time taken by a single pointed tool, one sharpening of the Rivett-Dock Tool is equal to an hundred grindings of the single point. The accuracy of the Rivett-Dock Tool is not to be obtained by the single point tool under any conditions and finally the Rivett-Dock Tool doesn't cost much as it is sent on trial for a month if desired.

Book describing sent on request.

Rivett-Dock Co., Brighton, Boston, Mass., U.S.A.

See FANEUIL WATCH TOOL CO. adv. of Rivett Internal Grinder No. 6 on page 20.

Heavy Floor Grinder



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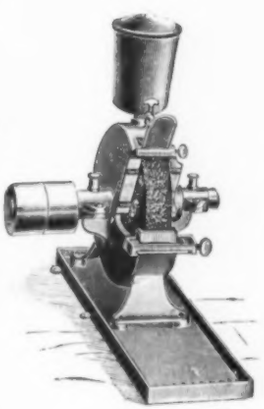
Made in Two Sizes



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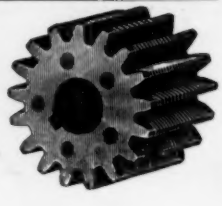

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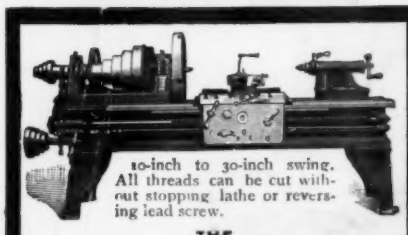

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FOUNDRY STATISTICS

are incomplete without blower data. Horse powers, air deliveries, pressures, amount of iron melted in a given time—the blower has much to do with it. If the make bears the name BUFFALO, you need not worry about the results.

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